Magnetic Analysis of Molten Iron Base Alloys

curve for the dependence of the magnetic susceptibility on concentration is smooth (Fig.3). Thus, in spite of the fact that cobalt is very close in its properties to iron, it does not form ideal solutions with iron. In liquid Fe-Co solutions there are regions which differ from one another structurally. The difference in solution structure also leads to different behaviour in chemical reactions, in particular during solution of gases. There are 3 figures, 13 references, 11 of which are Soviet, 2 English.

SUBMITTED: May 10, 1958.

SOV/24-58-11-2/42

AUTHOR: Samarin, A. M.

TITLE: Academician I. P. Bardin on the Occasion of his 75th Birthday

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 11, pp II-IV (USSR)

ABSTRACT: Brief description of the career and achievements of this internationally known metallurgist. All the information about Academician Bardin given in this paper is well known.

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21(5) 21(8)
AUTHORS: Samarin,A.M.,Corresponding Member,AS USSR SOV/30-58-11-4/48
Fomichev,M.S., Candidate of Technical Sciences

TITLE: Radioactive Isotopes and Nuclear Radiation in Technical Engineering (Radioaktivnyye izotopy i yadernyye izlucheniya v tekhnike)

PERIODICAL: Vestnik Akademii nauk SSSR, 1958, Nr 11, pp 22-27 (USSR)

ABSTRACT: The 2nd international conference for the use of atomic energy for peaceful purposes took place in Geneva in September. It demonstrated the universal use of radioactive isotopes and nuclear radiation in various branches of science and industry. The representatives of the USSR reported on results of researches on the physical properties of thulium-170, europium-155, and cerium-144 as sources of radiation. Experiments were made to employ them for quality control of welded, soldered, cast, and other thin-walled products of alloys based on iron, titanium, aluminum, and magnesium.
In Czechoslovakia controls of welding seams of steam turbines, casts of iron, steel, and bronze are carried out by means of the isotopes cobalt-60, iridium-192, cesium-137, thulium-170. In order to investigate the effect of lubricant admixtures tests were carried out in the USSR with admixtures marked by radioactive isotopes C^{14}, P^{32},

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Radioactive Isotopes and Nuclear Radiation in Technical Engineering

S^{35}. Furthermore the following fields of application of radioactive isotopes and nuclear radiation are mentioned: in the mineral oil industry for the determination of the technical state of drill holes etc.; in the field of mining and utilization of mineral resources; in developing new ways for advancing metallurgical industry; technological researches; examination of the hydrodynamic state of liquid phases in the tank of a Martin furnace; examination of diffusion in metals and alloys; examination of friction and wear in mechanical engineering; application of nuclear radiations in measuring technique and machine tool construction. As far as machine parts, mechanisms, and other metal products are concerned, gamma defectoscopy ranks first among the control methods by means of radioactive radiation. For this control besides of the isotopes cobalt-60, cesium-137, europium-152 and 154, thulium-170, and others, gamma radiation of betatrons is now employed. Radioactive isotopes and radiation are used for the investigation of processes in steam power plants. These methods of examination are also employed in hydrotechnology, soil mechanics and engineering geology.

SHARF, G., inzh.; AVERIN, V.V., kand.tekhn.nauk; POLYAKOV, A.Yu., prof., doktor tekhn.nauk; SAMARIN, A.M., prof.

Effect of silicon on the solubility and activity of oxygen in liquid nickel. Izv.vys.ucheb.zav.; chern.met. no.11:29-36 N '58. (MIRA 12:1)

1. Institut metallurgii imeni Baykova. 2. Chlen-korrespondent AN SSSR (for Samarin).

(Nickel alloys--Metallurgy)
(Silicon)

32-3-20/52

AUTHORS: Vertman, A.A., Samarin, A.M.

TITLE: The Measuring of the Magnetic Susceptibility of Liquid Metals (Izmereniye magnitnoy vospriimchivosti zhidkikh metallov)

PERICDICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 3, pp. 309-310 (USSR)

ABSTRACT: An apparatus, which is based upon Faraday's measuring method was constructed. The modification of the weight of the test sample in the magnetic field is proportional to magnetic susceptibility (with the volume of the sample being constant). In a liquid state the volume depends on temperature, but magnetic properties are determined by the composition of the molten metal. The device described makes it possible to measure the magnetic properties of the metals to be investigated by carrying out comparative determination of the tension and susceptibility of standard samples. The result is computed according to a formula. A detailed description of the electromagnetic scales of the device (operating with an accuracy of up to ± 0.001 g) has previously been given (Refs. 6,7). By means of the device described determinations of susceptibility were carried out for liquid alloys of iron-

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The Measuring of the Magnetic Susceptibility of Liquid Metals

32-3-20/52

nickel, nickel-cobalt, and iron-silicon at 1700° C. There are 1 figure, and 7 references, 6 of which are Slavic.

ASSOCIATION: Institute for Metallurgy AS USSR (Institut metallurgii Akademii nauk SSSR)

AVAILABLE: Library of Congress

1. Liquid metals-Magnetic properties 2. Electromagnetic scales-Applications

Card 2/2

20-119-5-41/59

AUTHOR: Samarin, A.M., R.A. Karasev. Corresponding AS USSR, and Karasev, R.A.

TITLE: The Desoxidation Capability of Carbon in Vacuum (O raskislitel'noy sposobnosti ugleroda v vakuume)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 119, Nr 5, pp. 990-992 (USSR)

ABSTRACT: In order to determine the pressure dependence of the desoxidation Capability of carbon a series of experimental meltings was carried out in which liquid iron with various concentrations of carbon in high vacuum was exposed to a certain temperature until the beginning of equilibrium between the carbon and oxygen dissolved in liquid iron. These experiments were carried out at a pressure of $(5 - 7).10^{-6}$ torr in a resistance furnace. A molybdenum spiral served as heating device. Crucibles of MgO, Al_2O_3, ThO_2, ZrO_2 and BeO proved to be unsuitable and therefore the melting experiments were carried out in corundum crucibles. The results obtained in these experiments are compiled in a table. The experimentally found oxidation

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capability at 1590°C is markedly smaller than the desoxidation capability computed from the value of the constant of the reaction equilibrium. The values found at pressures of 10^{-2} and 10^{-6} torr fit well on one and the same curve. Thus a change of the pressure of the gaseous phase by the 104-fold in this field has no effect on the desoxidation capability of carbon in liquid iron. The influence of the vacuum on the increase of the desoxidation capability of carbon at various concentrations of carbon are in full agreement with the rules of a reaction taking place in liquid metallic solution under the formation of a new gaseous phase. The difference between the experimental and the computed values of the capability of desocidation in vacuum is based only on the incorrect interpretation of an equation mentioned, which fact is reasoned in detail. The necessary pressure in the furnace must amount to from 1 - 2 torr for the complete desoxidation of liquid iron by the carbon dissolved in it. There are 1 figure, 1 table, and 6 references, 2 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A.A. Baykova Akademii nauk SSSR

The Desoxidation Capability of Carbon in Vacuum 20-119-5-41/59

(Institute for Metallurgy imeni A.A. Baykov AS USSR)

SUBMITTED: May 4, 1957

Card 3/3

SOV/ 20-120-2-22/63

AUTHORS: Vertman, A.A., Samarin, A.M., Corresponding Member, Academy of Sciences, USSR

TITLE: On the Form of Silicon in Liquid Iron (O forme sushchestvovaniya kremniya v zhidkom zheleze)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 2, pp. 309 - 310 (USSR)

ABSTRACT: The problem of the existence of elements dissolved in liquid metals is, in spite of its great importance for the practice of metallurgical engineering, one of the least investigated. Experimenting at high temperatures is difficult and furthermore most researchers approached this problem from the standpoint of formal thermodynamics (Reference 1). The authors describe the methods by which data on the structure of liquid metals can be obtained (Reference 2-4). For this purpose the authors measured the magnetic susceptibility of liquid Fe-Si alloys (from 0 to 60% by weight of Si). The results of measurement in a special apparatus (Reference 5) at 1600°C are shown in relative

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units in figure 1. From it follows that the magnetic susceptibility χ is the lower the higher the degree of order in the solution. A minimum for χ was registered for melts containing 34% Si and corresponding to a stable chemical compound FeSi. This iron- silicide is stable at the steel-melting temperature (1500-1700°). Its presence is also confirmed by other characteristics (References 6-8). It was reported that the Kurnakov point (References 9-10) which characterizes the transformation order-disorder in alloys of the Fe-Si system and in the alloy Fe-Al-Si lies close to the melting point or possibly also higher. Conclusions: 1) The magnetic susceptibility of the melts of the Fe-Si system has minimal values for compositions which correspond to the chemical compounds Fe_3Si, Fe_3Si_2 and $FeSi_2$. This is a direct proof of the existence of silicide-like structural formations in the melts. 2) The magnetic susceptibility in the melts decreases with an increase in the degree of order. It is minimal for chemical compounds and maximal for solutions with a complete mixture of atoms. 3) The structural changes in melts are connected with their chemical properties, especially with the

On the Form of Silicon in Liquid Iron SOV/ 20-120-2-22/63

gas solubility. There are 1 figure and 11 Soviet references.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute for Metallurgy imeni A. A. Baykov, AS USSR)

SUBMITTED: January 13, 1958

1. Liquid metals--Properties 2. Liquid metals--Heating
3. Iron-silicon alloys--Magnetic factors 4. Silicon--Metallurgical effects

Card 3/3

20-120-6-24/59

AUTHORS: Averin, V. V., Samarin, A. M., Corresponding Member, Academy of Sciences, USSR

TITLE: The Effect of Silicon on the Solubility of Oxygen in Iron and Chromium Melts (Vliyaniye kremniya na rastvorimost' kisloroda v rasplavakh zheleza i khroma)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 120, Nr 6, pp 1253 - 1254 (USSR)

ABSTRACT: In these experiments the silicon content did not exceed 1,5%, the temperature was 1600°. The method of investigation was described earlier (Refs 1,2). The results are shown on table 1. The following conclusions can be drawn from it: 1) The oxygen solubility in iron and chromium melts determined experimentally agrees well with the data published earlier (Refs 3,4). 2) An addition of 10% nickel does not noticeably influence the solubility. Thus, the maximum solubility of oxygen in stainless steels can be estimated on the basis of the study of the solubility in binary iron and chromium melts. This addition of nickel leads to a slight change of concentration of oxygen at a change of the proportion between iron and chromium. 3) The presence of chromium reduces considerably the deoxydizing power of silicon

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in the mentioned melts. 5) In the case of a constant chromium content (more than 10% Cr) the deoxydizing power of silicon decreases with its increase of concentration. 6) In the range of the silicon concentrations investigated (0,2 - 1,5%) the equilibrium oxide-phase which forms due to the interaction of the gas mixture with the liquid metal mainly consisted of silica. There are 1 figure and 4 references, 3 of which are Soviet.

SUBMITTED: March 26, 1958

1. Oxygen--Solubility 2. Silicon--Chemical effects 3. Chromium -iron alloys--Deoxidation 4. Nickel--Chemical effects

SOV/2c-122-4-15/57

13(3)

AUTHORS: Fedotov, V. P., Samarin, A. M., Corresponding Member, Academy of Sciences, USSR

TITLE: The Solubility of Nitrogen in Liquid Iron and in Melts of Iron and Silicon (Rastvorimost' azota v zhidkom zheleze i rasplavakh zheleza i kremniya)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 122, Nr 4, pp 597-599 (USSR)

ABSTRACT: This paper deals with the following problem: The solubility of nitrogen in melts of iron and silicon are to be determined, the causes of the discrepancies in the previous investigation and of the anomalous behavior of nitrogen in these melts are to be found. The apparatus for the investigation of the solubility of nitrogen was described in a previous paper (Ref 6). Carbonyl iron, silicon KrO ; and silicon of the kind 99,99 were used as initial materials. The authors investigated 4 series of melts, the preparation of which is described. The following conclusions can be drawn from the experimental results obtained: The solubility of nitrogen in liquid iron depends on the content of oxygen in iron (i.e.

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The Solubility of Nitrogen in Liquid Iron and in Melts of Iron and Silicon

on the oxygen bound in the oxides and also on the oxygen contained in the solution). The discrepancy between the results of the previous papers on this subject are caused not only by the different experimental errors, but also by the neglect of the influence of oxygen on the solubility of nitrogen in liquid iron. The solubility of nitrogen in liquid iron and in melts of iron and silicon (if their content of oxygen is of medium value) grows with increasing temperature and decreases with the increase of the silicon concentration. Moreover, this solubility of nitrogen satisfies the law of A. Sieverts (Siverts, Ref 1) for the influence of the pressure. The rate of the cooling of the melt from the experimental temperature to the point of solidification exercises considerable influence on solubility . The content of nitrogen in iron and in iron-silicon alloys can be diminished by tempering in a vacuum and in a helium atmosphere at 1100-1350° for 24 - 72 hours. Such a treatment in a vacuum noticeably purifies iron and its alloys with silicon. There are 2 figures, 3 tables, and 6 references, 2 of which are Soviet.

SOV/2o-122-4-15/57

The Solubility of Nitrogen in Liquid Iron and in Melts of Iron and Silicon

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences, USSR)

SUBMITTED: June 19, 1958

Card 3/3

SAMARIN, A.M

24(8) PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotemperaturnykh issledovaniy, 1956

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Akademiya nauk SSSR. Institut metallurgii. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

Resp. Ed.: A.M. Samarin, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: A.L. Bankvitser.

PURPOSE: This book is intended for metallurgists and metallurgical engineers.

COVERAGE: This collection of scientific papers is divided into six parts: 1) thermodynamic activity and kinetics of high-temperature processes 2) constitution diagram studies 3) physical properties of liquid metals and slags 4) new analytical methods and production of pure metals 5) pyrometry, and 6) general questions. For more specific coverage, see Table of Contents.

Investigations were made of the spectral radiating power of the surface of metal baths of various chemical compositions using various methods. Results were in agreement. The regularities established determined the connection between color temperature and actual temperature of clean and oxidized metal-bath surfaces. On the basis of a large number of investigations it was established that the value of the coefficient of transition from color temperature to actual temperature has practically no relationship to the presence of alloying elements and is unvarying in the presence of carbon between the limits of 0.01 and 3.5 percent. A comparison of various methods of radiation pyrometry showed that the optical spectral-ratio method is the most effective for continuous temperature control and thermography of liquid metal.

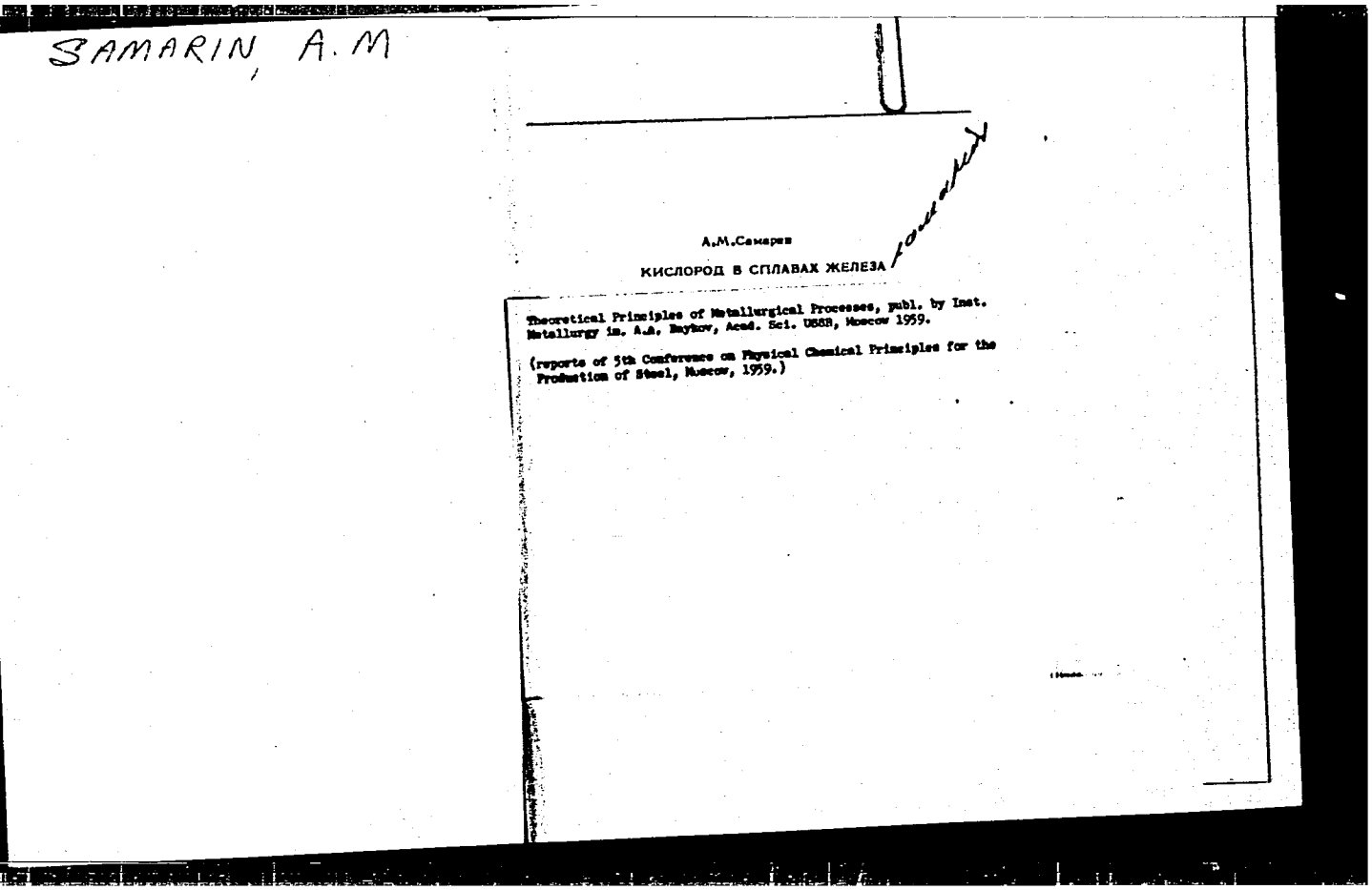
SAMARIN, A.M.

SAMARIN, A. M.

ДЕГАЗАЦИЯ СТАЛИ И СПЛАВОВ

М.А.Шумилов, П.В.Гельд, Ф.А.Сидоренко	Некоторые особенности процесса рассыпания ферросилиция.
Р.А.Рябов, П.В.Гельд	Влияние углерода на водопроницаемость стали.
Г.Н.Окороков, А.Ю.Поляков, А.М.Самарин	Особенности раскисления стали при дуговом вакуумном переплаве.
А.М.Самарин, М.П.Кузнецов, Д.П.Ульянов, Л.М.Новик, А.И.Лукутин	Повышение качества бессемеровских рельсов методом вакуумной обработки в ковше.
Г.Н.Ойкс, И.И.Ансимов, Г.А.Соколов, В.И.Данилин, В.Д.Каменов	Новая технология производства шарикоподшипниковой стали с применением вакуума.
П.Я.Агеев, Б.Г.Чернов	Влияние легирующих на поведение кислорода и азота при плавке его в вакууме.
И.В.Пазз[illegible], Э.И.Серебрянский	Влияние технологических факторов вакуумной дуговой плавки на содержание газов и неметаллических включений в шарикоподшипниковой стали.
Т.М.Воробьева, И.П.Зайцев, Е.С.Калинников	Влияние вакуумирования при [illegible] на [illegible] и [illegible] на качество стали 30ХГСНА.

report submitted for the 5th Physical Chemical Conference on Steel Production, Moscow-- 30 Jun 1959.



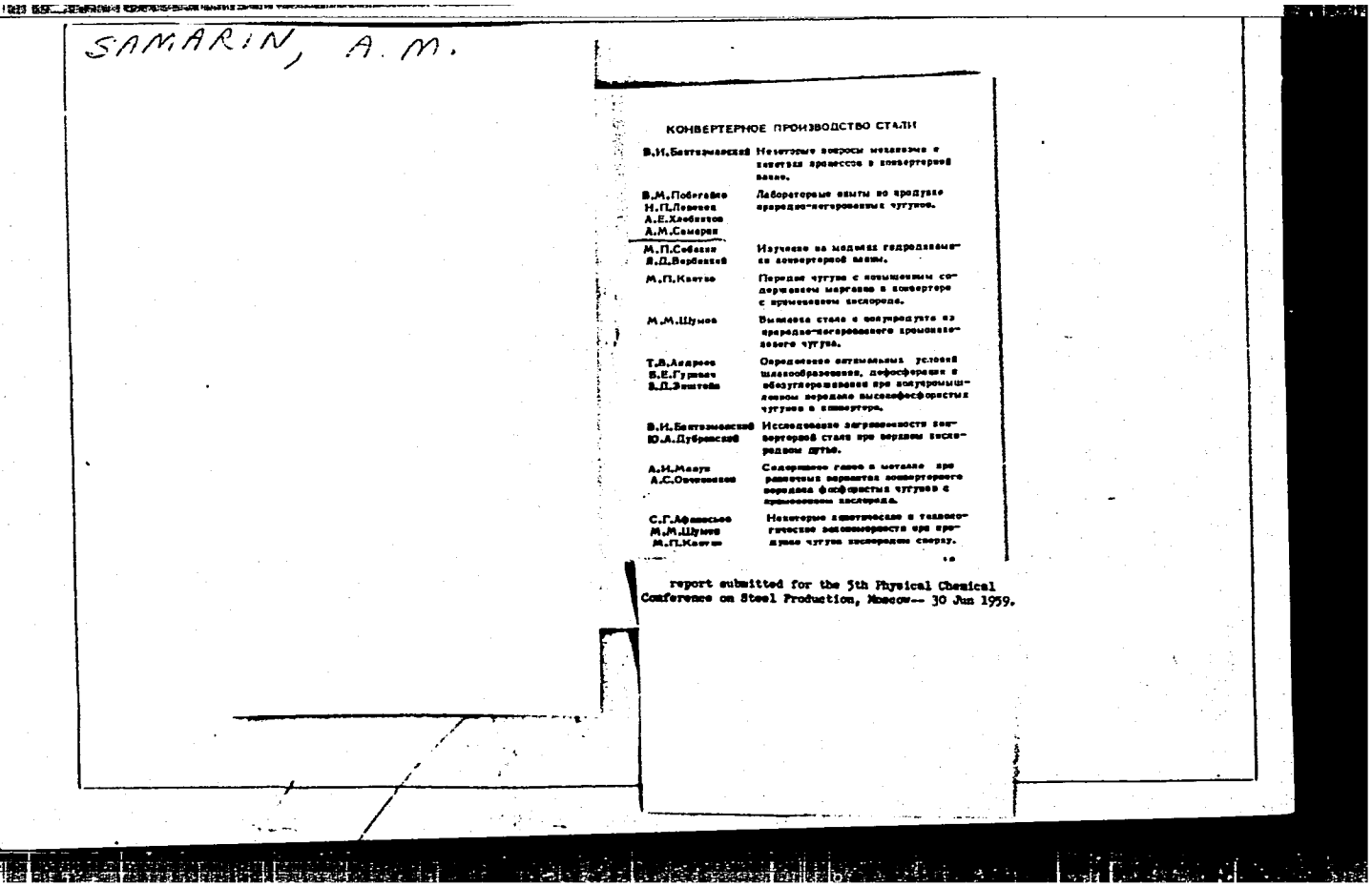
SAMARIN, A.M

А.М.Самарин

КИСЛОРОД В СПЛАВАХ ЖЕЛЕЗА

Theoretical Principles of Metallurgical Processes, publ. by Inst. Metallurgy im. A.A. Baykov, Acad. Sci. USSR, Moscow 1959.

(reports of 5th Conference on Physical Chemical Principles for the Production of Steel, Moscow, 1959.)

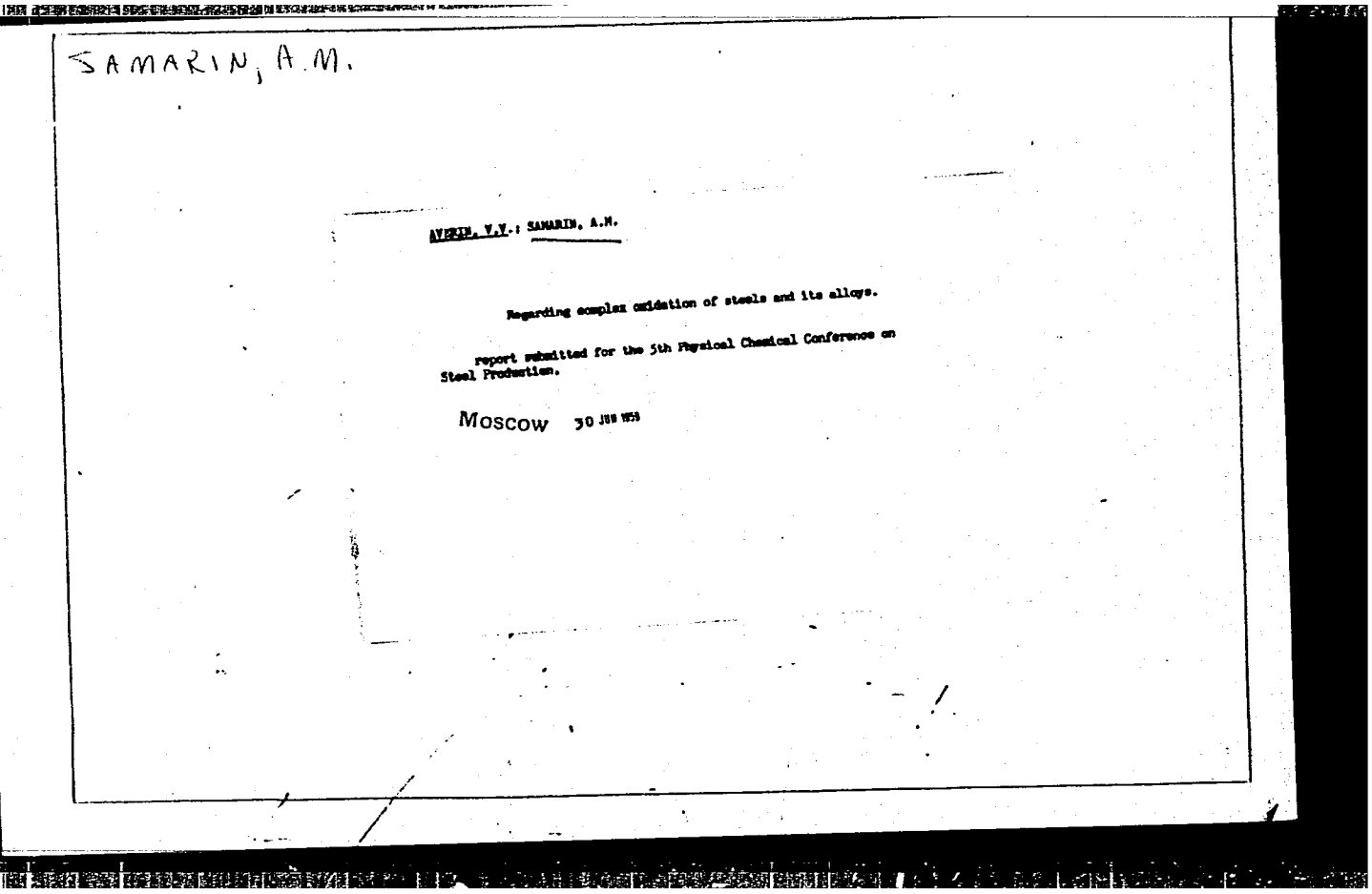


SAMARIN, A. M.

КОНВЕРТЕРНОЕ ПРОИЗВОДСТВО СТАЛИ

В.И.Баптизманский	Некоторые вопросы механизма и кинетики процессов в конвертерной ванне.
В.М.Побегайло Н.П.Лякишев А.Е.Хлебалов А.М.Самарин	Лабораторные опыты по продувке природно-легированных чугунов.
М.П.Собакин В.Д.Варбанский	Изучение на модели гидродинамики конвертерной ванны.
М.П.Квятко	Передел чугуна с повышенным содержанием марганца в конверторе с применением кислорода.
М.М.Шумов	Выплавка стали с контролируемым из природно-легированного хромистого чугуна.
Т.В.Андреев Б.Е.Гуревич З.П.Эпштейн	Определение оптимальных условий шлакообразования, дефосфорации и обезуглероживания при полупромышленном переделе высокофосфористых чугунов в конвертере.
В.И.Баптизманский Ю.А.Дубровский	Исследование загрязненности конвертерной стали при верхней кислородной дутье.
А.И.Манух А.С.Овчинников	Содержание газов в металле при различных вариантах конвертерного передела фосфористых чугунов с применением кислорода.
С.Г.Афанасьев М.М.Шумов М.П.Квятко	Некоторые технические и технологические закономерности при продувке чугуна кислородом сверху.

report submitted for the 5th Physical Chemical Conference on Steel Production, Moscow -- 30 Jun 1959.



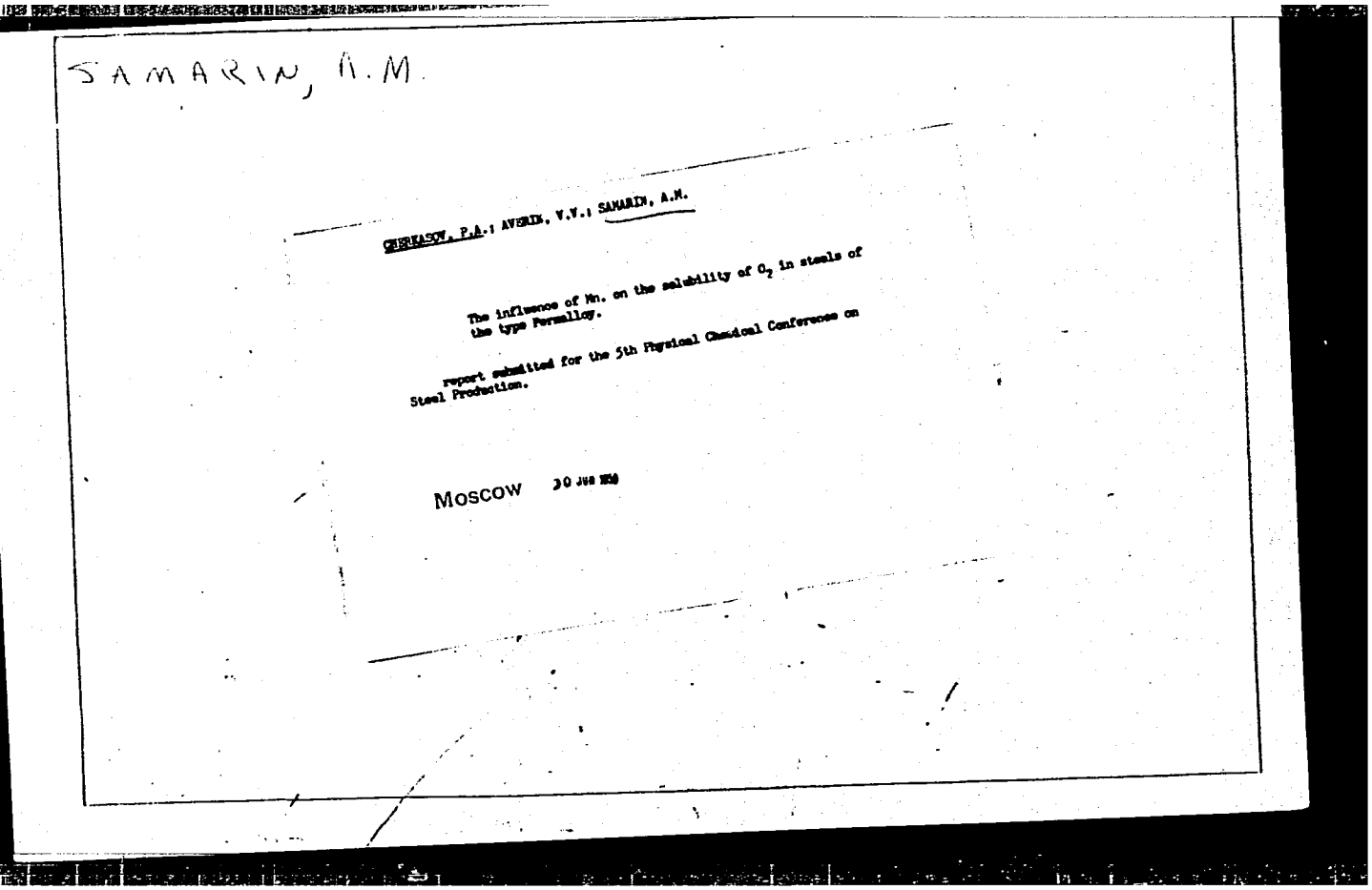
SAMARIN, A.M.

AVERIN, V.V.; SAMARIN, A.M.

Regarding complex oxidation of steels and its alloys.

Report submitted for the 5th Physical Chemical Conference on Steel Production.

Moscow 30 JUN 1959



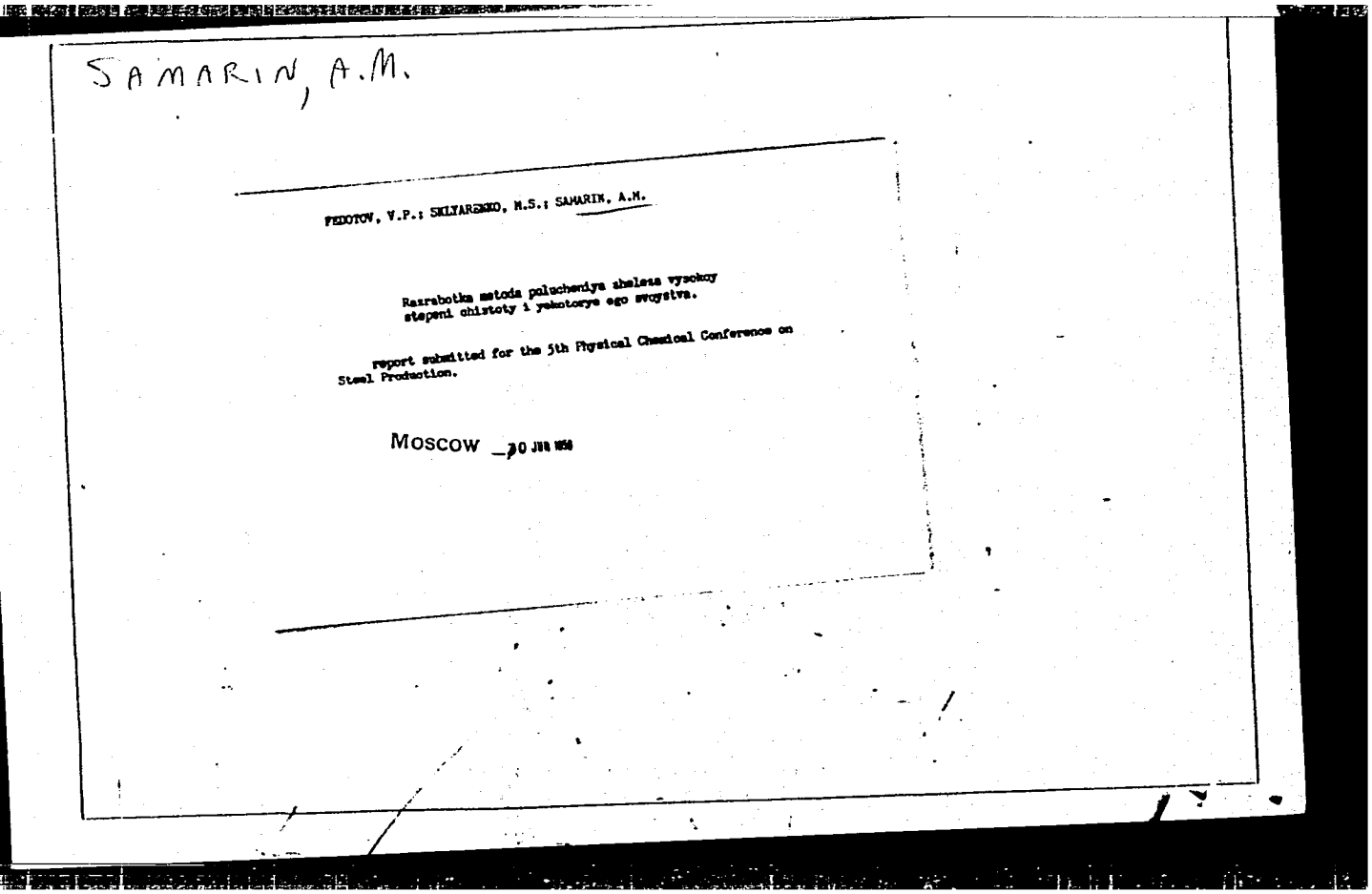
SAMARIN, A.M.

CHERKASOV, P.A.; AVERIN, V.V.; SAMARIN, A.M.

The influence of Mn. on the solubility of O_2 in steels of the type Permalloy.

Report submitted for the 5th Physical Chemical Conference on Steel Production.

MOSCOW 30 Jun 1958



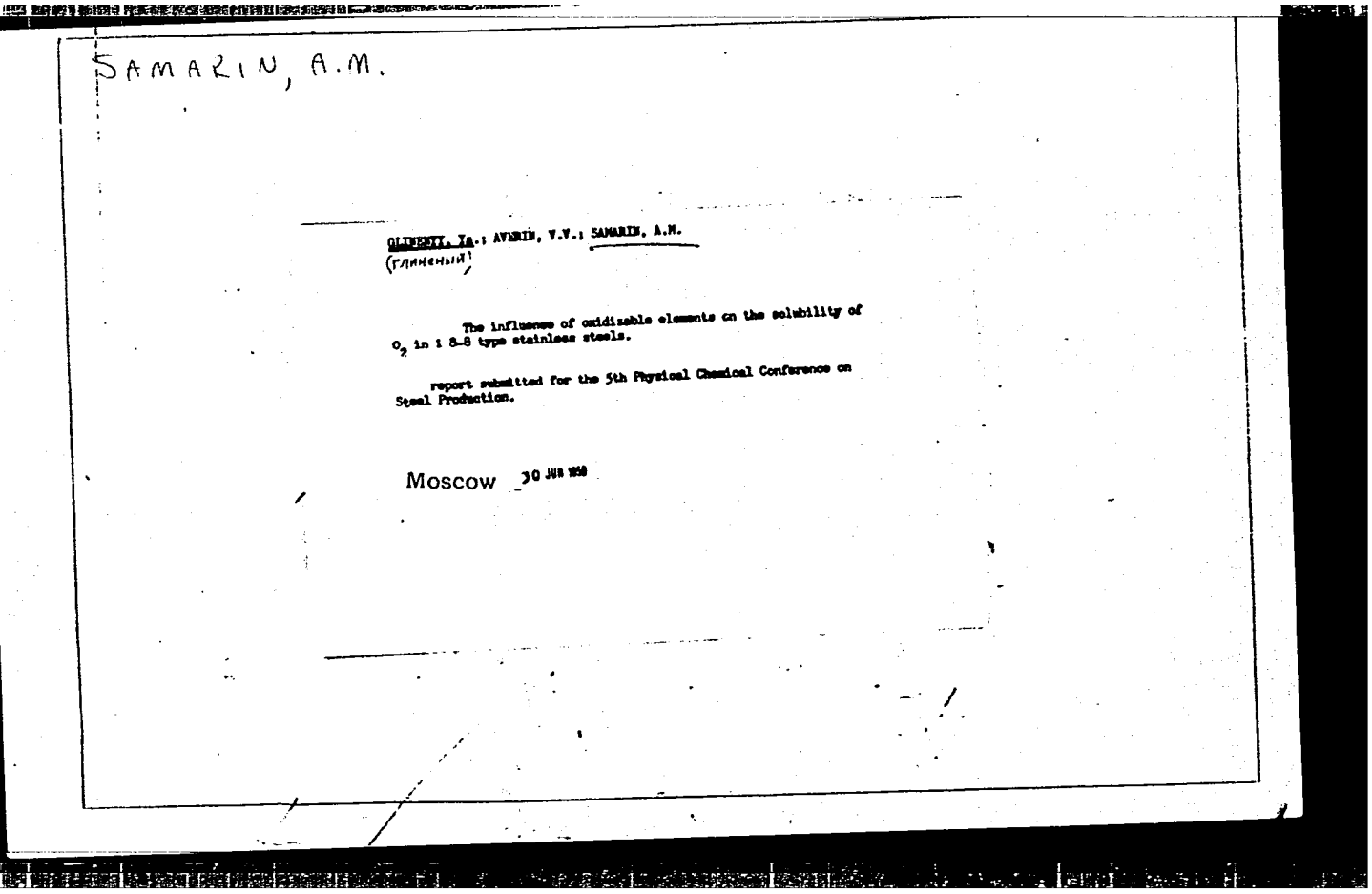
SAMARIN, A.M.

FEDOTOV, V.P.; SKLYARENKO, M.S.; SAMARIN, A.M.

Razrabotka metoda polucheniya zheleza vysokoy stepeni chistoty i yekotorye ego svoystva.

report submitted for the 5th Physical Chemical Conference on Steel Production.

Moscow 30 JUN 1958



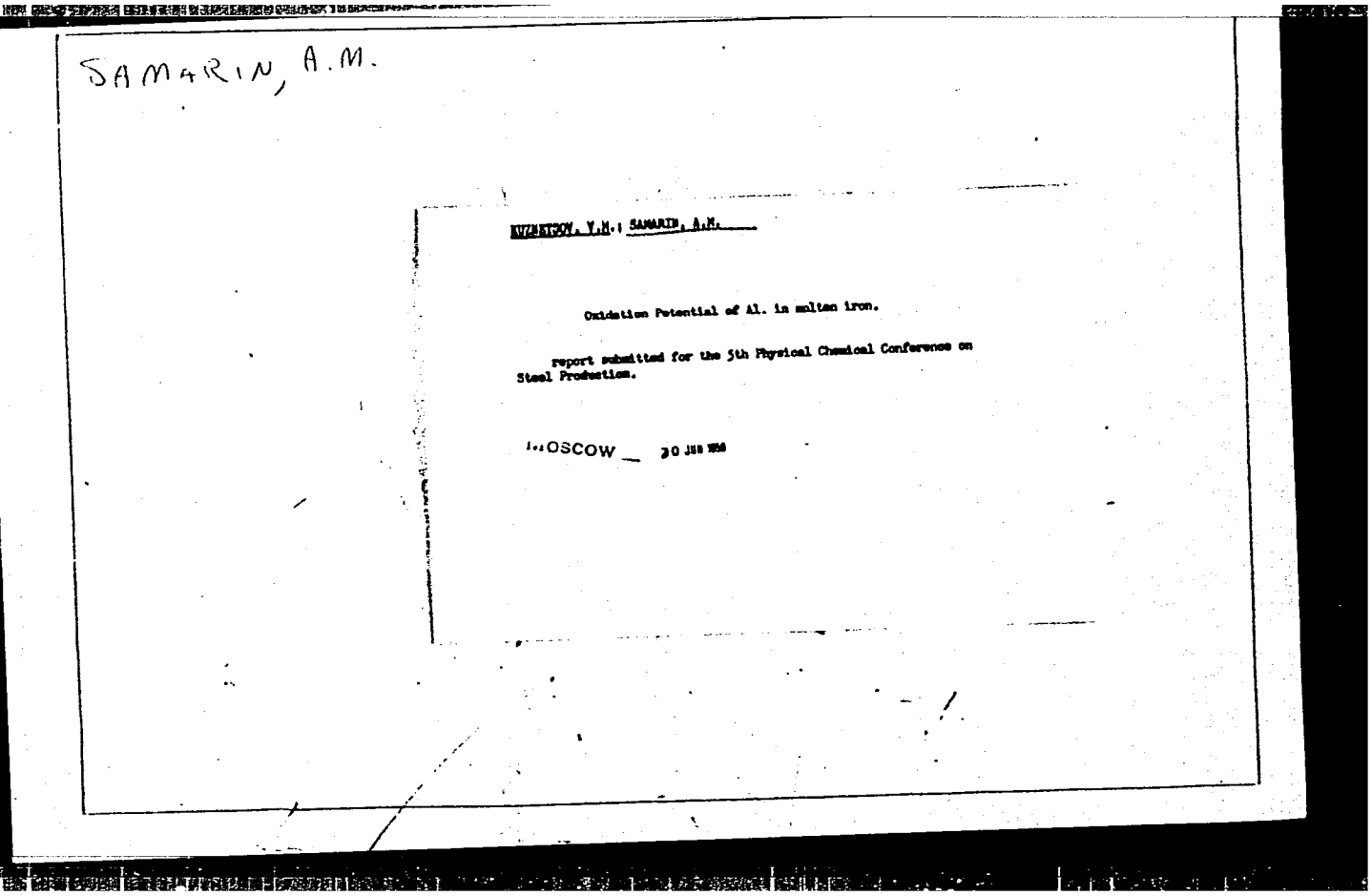
SAMARIN, A.M.

OLSHANSKIY, Ya.; AVERIN, V.V.; SAMARIN, A.M.
(Глиненый)

The influence of oxidizable elements on the solubility of O_2 in 1 8-8 type stainless steels.

report submitted for the 5th Physical Chemical Conference on Steel Production.

Moscow 30 JUN 1958



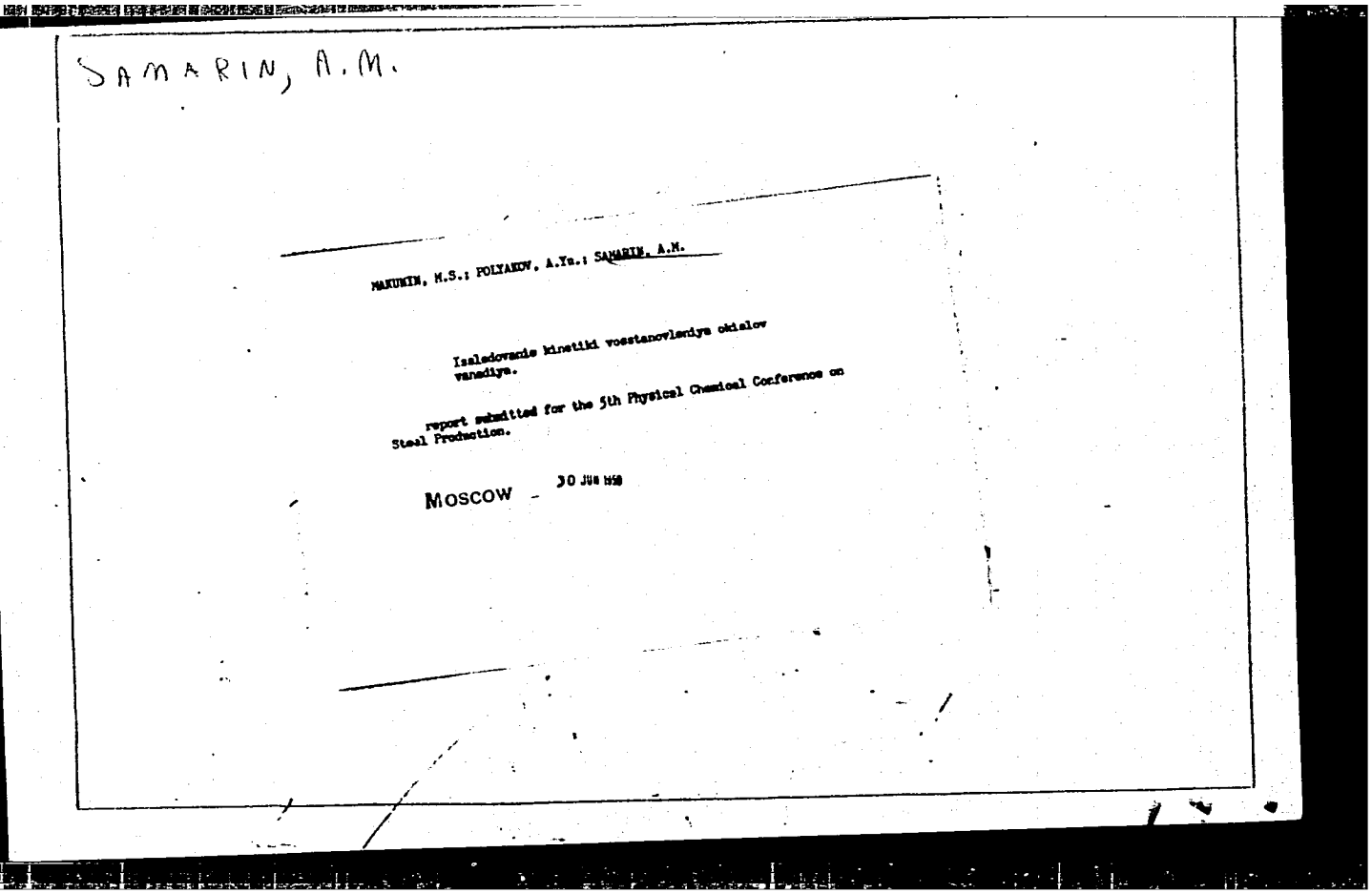
SAMARIN, A.M.

KUZNETSOV, V.I.; SAMARIN, A.M.

Oxidation Potential of Al. in molten iron.

report submitted for the 5th Physical Chemical Conference on Steel Production.

MOSCOW 30 JUN 1958



SAMARIN, A.M.

MAKUNIN, M.S.; POLYAKOV, A.Ya.; SAMARIN, A.M.

Issledovanie kinetiki vosstanovleniya okislov vanadiya.

report submitted for the 5th Physical Chemical Conference on Steel Production.

MOSCOW 30 JUN 1958

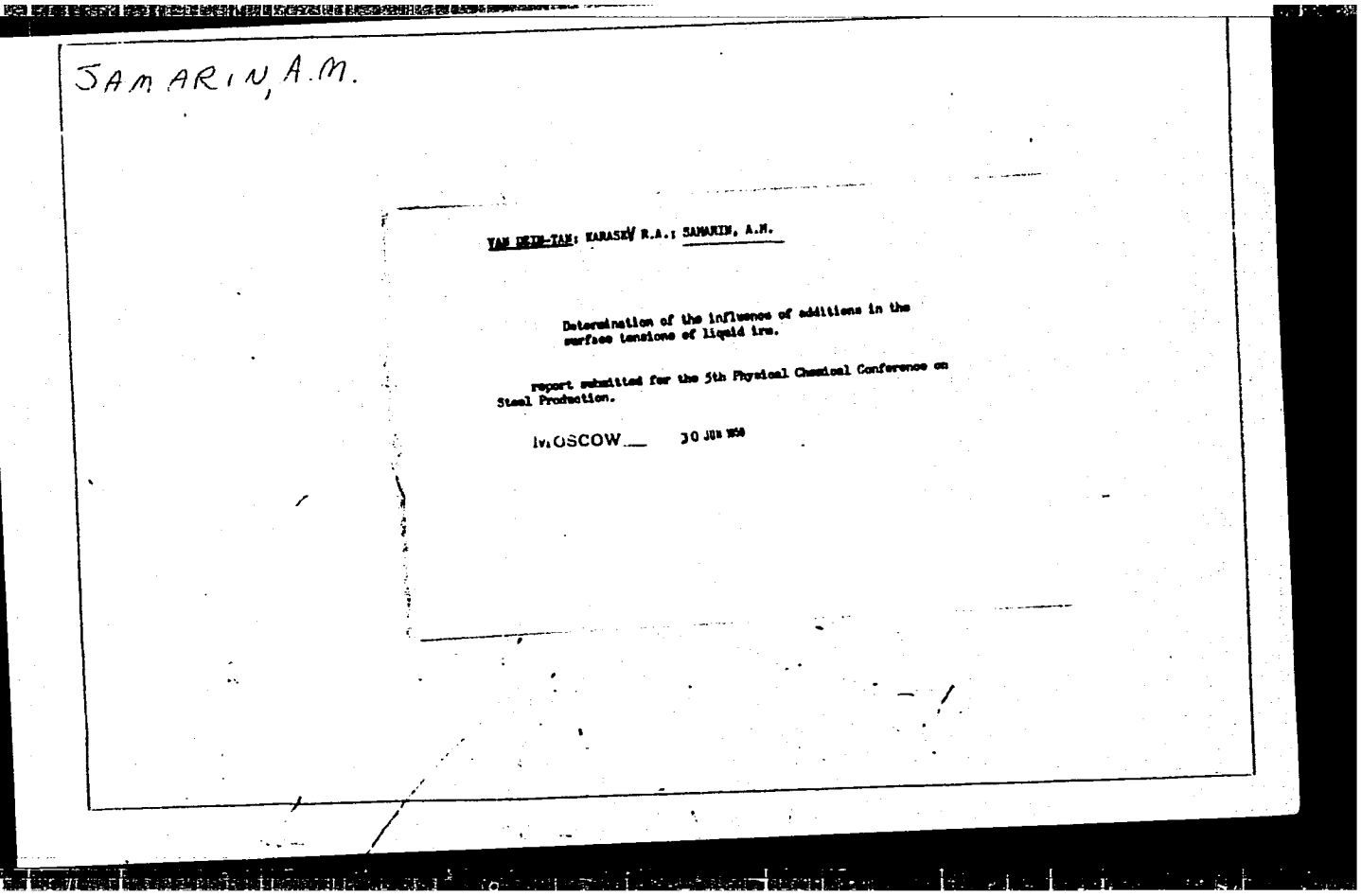
SAMARIN, A.M.

~~AUTH: TSVI, Ova~~: POLYAKOV, A.Yu.; SAMARIN, A.M.

Determination of the activity of components in liquid alloys by the vacuum evaporation method.

report submitted for the 5th Physical Chemical Conference on Steel Production.

Moscow 30 JUN 1959



SAMARIN, A.M.

YAN DEIN-TAN: KARASEV R.A.; SAMARIN, A.M.

Determination of the influence of additions in the surface tensions of liquid iron.

report submitted for the 5th Physical Chemical Conference on Steel Production.

MOSCOW 30 JUN 1958

SAMARIN, A. M.

НЕМЕТАЛЛИЧЕСКИЕ ВКЛЮЧЕНИЯ СТАЛИ

С.И.Попель Г.Ф.Коновалов	Очистка кипящей стали от тугоплавких включений
С.Е.Волков А.М.Самарин	Влияние метода раскисления стали в индукционной печи на процесс ее десульфурации.
Д.К.Бутаков Л.М.Мельников	Влияние водорода на обособление серы в структуре литой стали.
С.Т.Ростовцев Д.И.Туркевич В.И.Баптизманский К.С.Просвирин	Окисные неметаллические включения в конвертерной рельсовой стали.
В.А.Уразова Ю.Т.Лукашевич-Дуванова	Включения в малоуглеродистой стали, содержащей титан.
Ю.Т.Лукашевич-Дуванова О.В.Демант Е.В.Крутенко	Включения в малоуглеродистой стали, содержащей церий и ниобий.
А.И.Хомяков	Осаждающее раскисление в процессах электроплавки стали.
С.Г.Воинов П.М.Даниловов	Разработка и внедрение новой технологии выплавки шарикоподшипниковой стали.
В.П.Карасев П.Я.Агеев	Возможные пути ускорения раскисления металла.

report submitted for the 5th Physical Chemical Conference on Steel Production, Moscow-- 30 Jun 1959.

BUNSH, R.F., red.; SAMARIN, A.M., red.; VINICHENKO, Ye.K., red.;
SHUVAL, G.M., red.; BELEVA, M.A., tekhn.red.

[Vacuum metallurgy] Vakuumnaia metallurgiia; sbornik dokladov.
Pod red. R.F.Bunsha. Moskva, Izd-vo inostr.lit-ry, 1959. 305 p.
Translated from the English. (MIRA 13:8)

1. Chlen-korrespondent AN SSSR (for Samarin).
(Vacuum metallurgy)

SAMARIN, A-M.

PHASE I BOOK EXPLOITATION SOV/3559

Akademiya nauk SSSR. Institut metallurgii. Nauchnyy sovet po probleme zharoprochnykh splavov

Issledovaniya po zharoprochnym splavam, t. 5 (Investigations of Heat-Resistant Alloys, Vol 5) Moscow, Izd-vo AN SSSR, 1959. 423 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V.A. Klimov; Tech. Ed.: I.F. Kuz'min; Editorial Board: I.P. Bardin, Academician, G.V. Kurdyumov, Academician, N.V. Ageyev, Corresponding Member, USSR Academy of Sciences (Resp. Ed.), I.A. Oding, I.M. Pavlov, and I.F. Zudin, Candidate of Technical Sciences.

PURPOSE: This book is intended for metallurgical engineers, research workers in metallurgy, and may also be of interest to students of advanced courses in metallurgy.

COVERAGE: This book, consisting of a number of papers, deals with the properties of heat-resisting metals and alloys. Each of the papers is devoted to the study of the factors which affect the properties and behavior of metals. The effects of various elements such as Cr, Mo, and W on the heat-resisting properties of various alloys are studied. Deformability and workability of certain metals as related to the thermal conditions are the object of another study described. The problems of hydrogen embrittlement, diffusion and the deposition of ceramic coatings on metal surfaces by means of electrophoresis are examined. One paper describes the apparatus and methods used for growing monocrystals of metals. Boron-base metals are critically examined and evaluated. Results are given of studies of interatomic bonds and the behavior of atoms in metal. Tests of turbine and compressor blades are described. No personalities are mentioned. References accompany most of the articles.

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SOV/180-59-1-4/29

AUTHORS: Averin, V.V., Polyakov, A.Yu. and Samarin, A.M. (Moscow)

TITLE: Solubility and Activity of Oxygen in Metallic Melts (Rastvorimost' i aktivnost' kisloroda v metallicheskikh rasplavakh)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 1, pp 13-21 (USSR)

ABSTRACT: The authors consider that the published attempts (Refs 1 and 2) to generalize the available experimental material on the activity of oxygen in iron and its alloys fail to elucidate changes in oxygen-activity and solubility. They give their own critical survey of the literature, as well as some unpublished data (V.A.Sarankin), from which they draw the following main conclusions. The solubility and activity of oxygen in metallic systems do not change additively over the whole concentration range of the components but depend on the composition of the oxide phase in equilibrium with the alloy of given composition. The composition of this phase depends mainly on the ratio of dissociation pressures of the components and to a lesser extent deviations from ideal-solutions laws. From experimental data on the activity of oxygen

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Solubility and Activity of Oxygen in Metallic Melts

in alloys the probable oxygen partial pressure for a saturated solution of oxygen in the pure component for the same temperature can be found approximately. This possibility is limited to solutions with similar component properties and for which the oxygen solubility and activity are proportional to concentration in the part of the solubility curve to the right of the minimum, eg Ni-Fe and Co-Fe from the minimum on the curve to pure iron and Fe-Cr from 12 to 100% Cr. The results examined point to a change in the activity of oxygen from the partial pressure corresponding to the saturated solution in one component to that for the other component at the same temperature. The main factor influencing the solubility of oxygen in alloys is the ratio between the dissociation pressures of the oxides of the components but the solubility of oxygen in the pure components and the interaction of components in the metallic and oxide phases also have significant effects. When a considerable difference exists between the dissociation pressures of the component oxides as, for example, in solutions of deoxidizers in iron, the addition of the deoxidizer

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Solubility and Activity of Oxygen in Metallic Melts

quickly reduces oxygen solubility because of the reduction in the oxygen partial pressure over the oxide phase formed. If the deoxidizer when its concentration is increased can form compounds with iron stable above their melting points, the further course of the oxygen-solubility curve will depend on the solubility of oxygen in the compound and the individual properties of the deoxidizer will appear in the composition range from the chemical compound to the pure deoxidizer. The change in the activity of oxygen in these composition ranges must similarly depend on the nature of the interaction between the component atoms.

Card 3/3 There are 3 figures, 3 tables and 13 references, 9 of which are Soviet, 3 English and 1 German.

SUBMITTED: June 23, 1958

SOV/148-59-1-3/19

18(3)

AUTHORS: Samarin, A.M., Professor, Corresponding Member of AS USSR; Polyakov, A.Yu., Doctor of Technical Sciences, Docent; Levenets, N.P., Candidate of Technical Sciences; and Pobegaylo, V.M., Engineer

TITLE: Development of an Efficient Technology for the Reduction of Kerch' Cast Iron (Razrabotka ratsional'noy tekhnologii peredela kerchenskikh chugunov)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallurgiya, 1959, Nr 1, pp 23-34 (USSR)

ABSTRACT: Experiments were carried out at the Institute of Metallurgy imeni A.A. Baykov for the purpose of finding an efficient technology of cast iron reduction permitting to obtain high-quality reduction products, such as steel with a low nitrogen and phosphorus content, vanadium slags with a high vanadium content and phosphate slags with a high phosphorus concentration. The cast iron reduction is planned to be carried out in two stages: by low temperature air blowing-through of the cast iron, for the purpose of vanadium and silicon extraction, and by high-temperature oxygen blowing-through of the semi-

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Development of an Efficient Technology for the Reduction of Kerch' Cast Iron

free from silicon and manganese, the P_2O_5 content in phosphate slags reaches 25%. The author presents graphs in which interrelation of various quantities is shown e.g. vanadium is plotted versus silica content, the slag composition is plotted versus the blowing-through time, etc.
There are 3 tables, 10 graphs, and 3 Soviet references.

ASSOCIATION: Institut metallurgii imeni A.A. Baykova (Institute of Metallurgy imeni A.A. Baykov)

SUBMITTED: December 22, 1958

Card 3/3

SOV/180-59-2-6/34

AUTHORS: Makunin, M.S., Polyakov, A.Yu., and Samarin, A.M. (Moscow)

TITLE: Properties of Vanadium Obtained by Carbon-Thermic Reduction in a Vacuum (Svoystva vanadiya, poluchennogo metodom ugletermicheskogo vosstanovleniya v vakuume)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i Toplivo, 1959, Nr 2, pp 35-39 (USSR)

ABSTRACT: In previous communications (Refs 1,2) results of experiments on a process for producing malleable vanadium by reduction of V_2O_3 with carbon in a vacuum at a temperature below the metal melting point, are given. Further work showed that the reduction should be effected in several stages (the final one at 1680 to 1750 °C and 10^{-3} - 5 x 10^{-4} mm Hg) with intermediate crushing and rebriquetting. Table 1 shows the weight percentage of carbon and oxygen in the final product, the values being shown as functions of each other for various conditions in Fig 2. A better relation between carbon and oxygen was obtained with a high-capacity type BN-3 booster pump than with a type TsVL-100 diffusion pump. In experiments on the production of cast vanadium it was found that contamination with tungsten and nitrogen took

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Properties of Vanadium Obtained by Carbon-Thermic Reduction in a Vacuum

place when briquettes were arc melted in an argon atmosphere with tungsten electrodes. Consumable electrodes of briquetted vanadium made in a vacuum attachment on a type MTP-150 butt-welding machine, gave a purer product. A.I. Pugin participated in this part of the work. The electrodes were fused in an arc furnace with a 37-40 mm diameter water-cooled copper mould at 5 x 10-4 mm Hg. A typical cast and forged ingot contained 0.07, 0.016 and 0.038 % carbon, oxygen and nitrogen, respectively, the nitrogen content being almost the same as in the briquette used for the electrodes. As annealing (1100°C in vacuo) produces no structural changes the resultant decrease in hardness is attributed by the authors to the removal of internal stresses generated during the rapid cooling in the mould. The ingot was forged with a 75-kg hammer with re-heating to 800°C to a reduction of 68.5%. The heating of the ingot before and during forging was effected in air, but oxidation and nitrogen pick-up (leading to hardening) were confined to the surface layers

Card 2/3 (Fig 4 shows micro-hardness as a function of distance from

Properties of Vanadium Obtained by Carbon-Thermic Reduction in a Vacuum

surface). Mechanical tests were carried out on type KRD-3 tensile test-pieces made from the hot-forged bar. The results for the forged state and after annealing at 1000°C (Table 2) show high plasticity and adequate strength. Part of the material was cold rolled to a reduction of 87% without intermediate annealing: little work-hardening occurred (Fig 5 shows hardness as a function of relation deformation), and a 1.1 mm cold-rolled plate was rolled without intermediate annealing to 1.2 - 1.5 micron thick foil. Corrosion tests in boiling HCl (10 and 17%) and H_2SO_4 (10, 17 and 30%) solutions showed (Table 3) high resistance, greatly superior to that of titanium or type 1 Kh18N9T steel.

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There are 5 figures, 3 tables and 3 Soviet references.

SUBMITTED: October 8, 1958

SOV/180-59-3-6/43

AUTHORS: Kashin, V.I. and Samarin, A.M. (Moscow)

TITLE: Melting Heat-Resisting Alloys in Vacuum Induction Furnaces

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 3, pp 29-33 (USSR)

ABSTRACT: The authors give results of a study of the effect of vacuum melting on the properties of a deformed nickel-base alloy. A previously described (Ref 1) 5 kg furnace was used to melt the appropriate mixture of pure metals or remelt alloy scrap. Zirconium-dioxide or magnesia crucibles were used. With pure metals ductility is particularly useful since normally titanium and aluminium-containing nickel-base alloys are difficult to work. Toughness of alloy re-melted at 10^{-2} mm Hg was 20% greater than initially. Vacuum melting reduces the dissolved hydrogen content from 0.0002 - 0.00008 to 0.00003 - 0.00005%; repeated remelting promotes hydrogen removal. Reduction in nitrogen content is most rapid in the first 15 to 20 minutes of exposure of melted alloy at 1500°C to a pressure of 10^{-2} mm Hg (Fig 2 shows two plots of percentage nitrogen in the metal against time in

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minutes). Large reductions (0.007 - 0.01 to 0.002 - 0.004%) in oxygen were also obtained (Fig 3) indicating that at low residual oxygen pressure, oxygen elimination proceeds also on account of floating of non-metallic oxide inclusions. No clear relation could be found for the alloy investigated between the contents of oxygen and carbon dissolved in the metal. The authors have also investigated the influence of leaks on the oxygen content of pure electrolyte nickel kept at 1550°C at various degrees of evacuation, samples being taken every 10 to 15 min. Table 2 shows the oxygen content (on melting and after 30 min); the rate of oxygen pick-up and the rate of leaking (mainly from the refractory, which was difficult to degas) for different crucibles and evacuations. The results are represented in Fig 4 as a plot of rate of change (in % per hour) of oxygen in metal against rate of leaking. Higher rates of leaking were found to give a higher metal oxygen content with poorer mechanical properties (Table 3). Some reduction of magnesia and zirconia by carbon was observed, the magnesium tending to evaporate and the zirconium to dissolve in the metal.

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Melting Heat-Resisting Alloys in Vacuum Induction Furnaces

There are 4 figures, 3 tables and 1 Soviet reference.

SUBMITTED: August 25, 1958

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SOV/133-59-3-14/32

AUTHORS: Samarin, A.M., Novik, L.M., Tsukanov, G.E., Kuznetsov, M.P. and Lukutin, A.I.

TITLE: Vacuum Treatment of Bessemer Steel (Vakuumnaya obrabotka bessemerovskoy stali)

PERIODICAL: Stal', 1959, Nr 3, pp 231-238 (USSR)

ABSTRACT: The application of vacuum treatment of Bessemer steel in a 22-ton ladle before teeming in order to improve the quality of steel was introduced at the Dzerzhinskiy Works in 1957. The design of the installation is outlined and the lay-out shown in Figure 1. Main point - the evacuation is effected by two parallel pairs of pumps, RVN60 and RVN-30, connected in series. The dependence of the output of pumps operating separately and connected in series on pressure is shown in Figure 2 and the change of pressure in the vacuo chamber with time in Figure 3. At the 8th minute of treatment the pressure in the chamber falls to 2 mm Hg. The gases pumped out of the chamber are cooled in a cooler and purified from dust in a cyclone and a filter. The investigation of the vacuo treatment on the quality of steel was carried out on 38 heats of rail steel and 17 heats of rimming steel. The duration of the treatment of

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Vacuum Treatment of Bessemer Steel

rail steel varied between 12-15 minutes during which the metal was boiling violently - its level was rising up to 500 mm. In all cases, the metal was deoxidised with ferromanganese and ferrosilicon during tapping into the ladle; aluminium (150 - 500 g/t) was introduced after the treatment when the steel was already well deoxidised. A number of heats were carried out in which vanadium (0.1 - 0.15%) or boron (0.005%) were introduced under vacuum through a special charging arrangement 3-4 minutes before the end of the treatment. The chemical composition of the metal remains practically unchanged during the vacuo treatment; the content of iron oxides in slag decreases by 20-30% and of silicon by 5-6% due to deoxidation with carbon. Changes in the content of oxygen in rail steel during the treatment and teeming are shown in Figure 4 and of hydrogen in Figure 5. Changes in the content of hydrogen in the treated steel along the depth of the ladle are shown in Figure 6; sulphur of a cross-section of rail from vacuo-treated and ordinary steel - Figure 7; the dependence of the tensile strength, relative elongation and relative necking of rails from ordinary and vacuo-

 treated steel with additions of aluminium and vanadium

Vacuum Treatment of Bessemer Steel

before and after normalisation on the sum of [C + 0.25 Mn] - Figures 8, 9 and 10, respectively; the dependence of the impact strength of rails from vacuo-treated and ordinary steel on Σ[C + 0.25 Mn] at 20 °C - Figure 11, at - 40 °C - Figure 12, after deformation ageing - Figure 13. The mean duration of the vacuo treatment of rimming steel was 14.5 minutes at a minimum pressure of 16 mm Hg. The process is accompanied by a violent boiling (the level of the metal rises by 600 - 700 mm). As the pumping capacity was insufficient to decrease sharply the content of nitrogen, it was combined into stable nitrides by additions to some heats of aluminium (300 - 1 000 g/t) or vanadium (0.1%). The additions were made through the charging installation 4-5 minutes before the end of the treatment. The content of carbon decreases by 0.03 - 0.06% during the treatment. Changes in the content of oxygen and hydrogen during the treatment - Figures 14 and 15, respectively; indices of impact strength of the ordinary and treated metal are shown in Figure 16 and the table. On the basis of the results obtained, the following conclusions are drawn: a) vacuo treatment of liquid metal

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in the ladle increases the quality of Bessemer steel to a level of the open-hearth steel; b) with the duration of the treatment of 14-15 minutes and a pressure in the chamber of 5-10 mm Hg for killed metal and of 15-20 mm Hg for rimming metal a deep degassing of the whole volume of the metal is obtained (the content of oxygen decreases 4.4 - 6 times, on average to 0.0013% in rail steel and to 0.0041 in rimming steel; the content of hydrogen decreases by a factor of more than 2, approximately to 2.4 cm^3/100 g in rail and to 2.4 cm^3/100 g in rimming steel ; the content of nitrogen in rimming steel decreases by 38.5%).
c) This decrease in the content of hydrogen in rail steel makes it flake insensitive without an application of slow cooling or isothermal treatment of the rolled product.
d) Vacuo treatment makes the deoxidation of aluminium unnecessary which, if needed, can be introduced after the treatment into the metal already well deoxidised by carbon. Alloying additions can be also introduced into already deoxidised metal at the end of the treatment through special charging installation in the top of the vacuo chamber.
e) Bessemer rails from vacuo-treated metal possess higher plastic properties and impact strength at positive and

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negative temperatures as well as after deformation ageing than rails made by the usual technology. On increasing carbon content to 0,8% and alloying with a small amount of vanadium (0.1 - 0.2%) or boron (0.003 - 0.005) or titanium (1-2 kg/t) and normalisation non-ageing rails can be obtained with higher physico-mechanical properties than those of rails from open-hearth steel. f) By vacuo treatment a good structural Bessemer steel can be obtained in which the zone of thermal influence of welded seam is not subjected to thermal ageing (decreased sensitivity of vacuo-treated metal to mechanical ageing is completely removed during normalisation of rolled products). There are 16 figures, 1 table and 2 Soviet references.

ASSOCIATIONS: Institut metallurgii AN SSSR (Institute of Metallurgy of the Ac.Sc.USSR) and Zavod im. Dzerzhinskogo (im. Dzerzhinskiy Works)

SOV/180-59-6-16/31

AUTHORS: Samarin, A.M., and Fomichev, M.S. (Moscow)

TITLE: Prospects for the Use of Radioactive Isotopes and Nuclear Radiations in Metallurgy and other Technical Sciences

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 6, pp 121-126 (USSR)

ABSTRACT: The authors give examples (without references) of recent applications of radioactive techniques in research and industry, including the following. In mining isotopes have been used to test oil wells; in surveying coal deposits the intensity of scattered radiation from a Co^{60} source at a counter which is adjacent but screened from direct radiation was used to detect coal seams. In steelmaking research on slag/metal transfer, the sources of non-metallic inclusions and the fluid dynamics of bath liquids has been carried out with the aid of tracers, practical benefits being obtained. In the field of ironmaking radioactive tracers have been used to study the descent of charge materials in the blast furnace, the consequent redesigns having increased productivity 10-20%;

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Prospects for the Use of Radioactive Isotopes and Nuclear Radiations in Metallurgy and other Technical Sciences

a further improvement was obtained from the benefits of being able to follow lining wear. Diffusion and solid-state reaction studies with the aid of tracers have contributed to the attainment of improved metal quality. In ore-dressing the selection of flotation reagents has been assisted by auto-radiographic work on reagent distribution in relation to structure. Radiography has been used in research on flow in glass-tanks. Radio-active materials have found wide use in instruments and measurement techniques, sometimes leading to process automation. This application alone is estimated by the Institut ekonomiki AN SSSR (Institute of Economics, Ac. Sc. USSR) to have given a saving in 1958 of the order of 500 million roubles, the figure for all the applications of radioactive isotopes and nuclear radiations being 1.6-1.8 milliard roubles; later the figure may rise to 4 milliard roubles annually. In addition to these and other examples of present uses, the authors discuss possible future uses and suggest directions for research and applications. Important among these are uses in

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studies of soil mechanics, filtration and movement of water underground (with the aid, among others, of tritium and deuterium).

SUBMITTED: October 24, 1959

Card 3/3

SAMARIN, A.

New methods for perfecting steel manufacturing. Tr. from the Russian. (To be contd.) p. 49.

KOHASZATI LAPOK. (Magyar Banyaszati es Kohaszati Egyesulet) Budapest, Hungary
Vol. 14, no. 2/3, Feb./Mar. 1959.

Monthly list of East European Accessions (EEAI), LC, Vol. 8, No. 8,
August 1959
uncla.

SAMARIN, A.

New methods for perfecting steel manufacturing. pt.2. p. 127.

KOHASZATI LAPOK. (Magyar Banyaszati es Kohaszati Egyesulet) Budapest, Hungary
Vol. 14, no. 4, Apr. 1959.

Monthly list of East European Accessions (EEAI), LC, Vol. 8 No. 8,
August 1959.
Uncla.

SOV/20-126-1-20/62

18(7),24(7)
AUTHORS: Samarin, A. M., Corresponding Member, AS USSR, Svet, D. Ya.

TITLE: The Radiation Power of Metals in the Liquid Phase (O lucheispuskatel'noy sposobnosti metallov v zhidkoy faze)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 1, pp 78-80 (USSR)

ABSTRACT: By a method of modulation reflectometry described in a previous paper (Ref 1), the authors determined the radiation power of the surface of a metal tank in the visible and near infrared spectral range. A germanium photocathode served as receiver of the infrared radiation energy. The measurements with this germanium photocathode were carried out in 2 spectral ranges with the effective wave lengths 1.0 and 2.0μ. In the visible range, the measurements were carried out with an antimony-cesium photocathode. The values of the radiation power found for various metals are illustrated in 4 diagrams. All measurements with the modulation spectrometer were carried out near the consolidation (crystallization) temperature. These diagrams also contain the values of the radiation power which were determined from the data on the spectral reflection coefficients

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of the same metals at room temperature (Ref 5). In comparing the results found, the absence of a corresponding difference not only in the character of the spectral distribution but also in the numerical values of the coefficients of radiation power for solid and liquid phases is striking for all metals investigated in the visible spectral range. The increase in radiation power of the metals in the liquid phase as compared with the solid phase in the near ultrared range of the spectrum can apparently be explained by a temperature factor, particularly by the dependence of the electric conductivity on temperature. This is also confirmed by the results obtained by other authors. The temperature-conditioned character of the radiation power of the metals in the liquid phase is also confirmed by the results determined for a melt of NiCu at λ 0.65μ . There are 4 figures and 15 references, 2 of which are Soviet.

SUBMITTED: January 31, 1959

MCHEDLISHVILI, Vakhtang Aleksandrovich; LYUBIMOVA, Galina Aleksandrovna; SAMARIN, Aleksandr Mikhaylovich; ZARVIN, Ye.Ya., red.; ROZEN-TSVEYG, Ya.D., red.izd-va; EVENSON, I.M., tekhn.red.

[Role of manganese in preventing the harmful effect of sulfur on the quality of steel] Rol' margantsa v ustranenii vrednogo vliianiia sery na kachestvo stali. Moskva, Gos.nauchno-tekhn. izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1960. 53 p. (MIRA 13:5)

(Manganese) (Steel--Metallurgy)

PHASE I BOOK EXPLOITATION SOV/5538

Samarin, Aleksandr Mikhaylovich

Obrabotka zhidkoy stali v vakuume (Vacuum Treatment of Molten Steel) Moscow, Metallurgizdat, 1960. 126 p. 2,500 copies printed.

Ed. of Publishing House: Ya. D. Rozentsveyg; Tech. Ed.: I. M. Evenson.

PURPOSE: This book is intended for engineers, metallurgists, and scientific workers; it may also be useful to students in schools of higher education and tekhnikums.

COVERAGE: Various methods for the vacuum treatment of steel are described. The advantages and shortcomings of each method are analyzed, descriptions of the devices used in vacuum treatment are provided, and detailed accounts of the effects of such treatment on the composition and properties of steel are given. No personalities are mentioned. There are 33 references: 12 Soviet, 11 German, and 10 English.

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PRONOV, Aleksey Petrovich; SAMARIN, A.M., otv.red.; KUDASHEVA, I.G., red.izd-va; BRUZGUL', V.V., tekhn.red.

[Crystallization of steel ingots] Kristallizatsiia stal'nogo slitka. Moskva, Izd-vo Akad.nauk SSSR, 1960. 148 p. (MIRA 13:3)

1. Chlen-korrespondent AN SSSR (for Samarin).
(Steel ingots) (Crystallization)

KOROL'KOV, A.M.; SAMARIN, A.M., otv.red.; CHERNOV, A.N., red.izd-va; ASTAF'YEVA, G.A., tekhn.red.

[Properties of metals used in founding] Liteinye svoistva metallov i splavov. Moskva, Izd-vo Akad.nauk SSSR, 1960. 195 p. (MIRA 13:7)

1. Chlen-korrespondent AN SSSR (for Samarin). (Metals) (Foundries--Equipment and supplies)

SAMARIN, A.M.

PHASE I BOOK EXPLOITATION SOV/4558
SOV/16-S-5

Akademiya nauk SSSR. Institut metallurgii

Metallurgiya, metallovedeniye, fiziko-khimicheskiye metody issledovaniya (Physicochemical Research Methods in Metallurgy and Metal Science) Moscow, Izd-vo AN SSSR, 1960. 251 p. (Series: Its: Trudy, vyp. 5) Errata slip inserted. 2,800 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova.

Resp. Ed.: I.P. Bardin, Academician (Deceased); Ed. of Publishing House: V.A. Klimov; Tech. Ed.: T.P. Polenova.

PURPOSE: This collection of articles is intended for metallurgists and metal researchers.

COVERAGE: The collection contains articles on metallurgy, metal science, and physicochemical research methods. Separate articles discuss the structure and properties of some metals and alloys. The effect of cold treatment and inclusions on the properties of alloys are analyzed, and instruments and

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Physicochemical Research Methods (Cont.) SOV/4558

methods used in investigating the processes occurring in metals and alloys are described. No personalities are mentioned. References accompany most of the articles.

TABLE OF CONTENTS:

SAMARIN, A.M.

PHASE I BOOK EXPLOITATION SOV/4548

Akademiya nauk SSSR. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali

Primeneniye vakuuma v metallurgii (Use of Vacuum in Metallurgy) Moscow, Izd-vo AN SSSR, 1960. 334 p. Errata slip inserted. 4,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali.

Resp. Ed.: A.M. Samarin, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: G.M. Makovskiy; Tech. Ed.: S.G. Markovich.

PURPOSE: This collection of articles is intended for technical personnel interested in recent studies and developments of vacuum steelmaking practice and equipment.

COVERAGE: The book contains information on steel melting in vacuum induction furnaces, and vacuum arc furnaces, reduction processes in vacuum, and degassing of steel and alloys. The functioning of apparatus and equipment, especially vacuum furnaces and vacuum booster pumps is also analyzed. Personalities are mentioned in connection with some of the articles and will appear in the Table of Contents. Three articles have been translated from English. Some of the

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articles are accompanied by references.

TABLE OF CONTENTS:

PART I. MELTING OF STEELS AND ALLOYS IN VACUUM INDUCTION FURNACES

Samarin, A.M.

PHASE I BOOK EXPLOITATION SOV/4443

Akademiya nauk SSSR. Komissiya po analiticheskoy khimii.

Metody opredeleniya primesey v chistykh metallakh (Methods of Determining Admixtures In Pure Metals) Moscow, 1960. 411 p. (Series: Its: Trudy, 12) 3,500 copies printed.

Resp. Eds.: A.P. Vinogradov, Academician, and D.I. Ryabchikov, Doctor of Chemical Sciences; Ed. of Publishing House: M.P. Volynets; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is intended for chemists, metallurgists, and engineers.

COVERAGE: The articles describe methods for detecting and determining various admixtures and their traces in pure metals. Also discussed are many chemical, physicochemical, electrochemical, spectrochemical and luminescence methods of analyzing materials of high purity. The editors state that these methods have been developed within the last five or six years by various Soviet scientific institutes, and are now widely used in research and factory laboratories of the Soviet Union. No personalities are mentioned. References, mostly Soviet, accompany each article.

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SAMARIN, A.M., otv.red.; CHERNOV, A.N., red.izd-va; POLYAKOVA, T.V., tekhn.red.

[Physicochemical principles of steelmaking; transactions of the 4th Conference on Physicochemical Principles of Steelmaking] Fiziko-khimicheskie osnovy proizvodstva stali; trudy IV konferentsii po fiziko-khimicheskim osnovam proizvodstva stali. Moskva, Izd-vo Akad.nauk SSSR, 1960. 419 p. (MIRA 13:4)

1. Konferentsiya po fiziko-khimicheskim osnovam proizvodstva stali, 4th. 2. Chlen-korrespondent AN SSSR (for Samarin). (Steel--Metallurgy) (Chemistry, Physical and theoretical) (Metallurgy--Congresses)

SAMARIN, A.M.

BOLDYREV, G.P.; VOGMAN, D.A.; NOVOKHATSKIY, I.P.; VERK, D.L.; DYUGAYEV, I.V.; KAVUN, V.M.; KURENKO, A.A.; UZBEKOV, M.R.; ARSEN'YEV, S.Ya.; YEGORKIN, A.N.; KORSAKOV, P.F.; KUZ'MIN, V.N.; STRELETS, B.A.; PATKOVSKIY, A.B.; BOLESLAVSKAYA, B.M.; INDENBOM, D.B.; FINKEL'SHTEYN, A.S.; SHAPIRO, I.S.; LAPIN, L.Yu.. Prinimali uchastiye: NEVSKAYA, G.I.; FEDOSEYEV, V.A.; KASPILOVSKIY, Ya.B., ZERNOVA, K.V.. BARDIN, I.P., akademik, otv.red.; SATPAYEV, K.I., akademik, nauchnyy red.; STRUMILIN, akademik, nauchnyy red.; ANTIPOV, M.I., nauchnyy red.; BELYANCHIKOV, K.P., nauchnyy red.; YEROFEYEV, B.N., nauchnyy red.; KALGANOV, M.I., nauchnyy red.; SAMARIN, A.M., nauchnyy red.; SLEDZYUK, P.Ye., nauchnyy red.; KHLEBNIKOV, V.B., nauchnyy red.; STREYS, N.A., nauchnyy red.; BANKVITSER, A.L., red.izd-va; POLYAKOVA, T.V., tekhn.red.

[Iron ore deposits in central Kazakhstan and ways for their utilization] Zhelezorudnye mestorozhdeniia TSentral'nogo Kazakhstana i puti ikh ispol'zovaniia. Otvetstvennyi red. I.P.Bardin. Moskva, 1960. 556 p. (MIRA 13:4)

1. Akademiya nauk SSSR. Mezhduvedomstvennaya postoyannaya komissiya po zhelezu. 2. Gosudarstvennyy institut po proyektirovaniyu gornykh predpriyatiy zhelezorudnoy i margantsevoy promyshlennosti i promyshlennosti nemetallicheskikh iskopayemykh (Giproruda) (for Boldyrev, Vogman, Arsen'yev, Yegorkin, Korsakov, Kuz'min, Strelets,

(Continued on next card)

BOLDYREV, G.P.--(continued). Card 2.
3. Institut geologicheskikh nauk AN Kazakhskoy SSR (for Novokhatskiy). 4. TSentral'no-Kazakhstanskoye geologicheskoye upravleniye Ministerstva geologii i okhrany nedr SSSR (for Verk, Dyugayev, Kavun, Kurenko, Uzbekov). 5. Nauchno-issledovatel'skiy institut mekhanicheskoy obrabotki poleznykh iskopayemykh (Mikhanobr) (for Patkovskiy). 6. Gosudarstvennyy institut proyektirovaniya metallurg.zavodov (Gipromez) (for Boleslavskaya, Indenbom, Finkel'shteyn, Nevskaya, Fedoseyev, Karpilovskiy). 7. Mezhduvedomstvennaya postoyannaya komissiya po zhelezu AN SSSR (for Shapiro, Zernova, Kalganov). 8. Gosplan SSSR (for Lapin).
(Kazakhstan--Iron ores)

MENDELEYEV, Dmitriy Ivanovich [deceased]; KEDROV, B.M., red.; PETROVSKIY, I.G., akademik, red.; ANDREYEV, N.N., akademik, red.; BYKOV, K.M., akademik, red. [deceased]; KAZANSKIY, B.A., akademik, red.; SHMIDT, O.Yu., akademik, red. [deceased]; SHCHERBAKOV, D.I., red.; YUDIN, P.F., akademik, red.; DELONE, B.N., red.; KOSHTOYANTS, Kh.S., red.; SAMARIN, A.M., red.; LEBEDEV, D.M., prof., red.; FIGUROVSKIY, N.A., prof., red.; KUZNETSOV, I.V., kand.filosof.nauk, red.; TRIFONOV, D.N., red.izd-va; NOVICHKOVA, N.D., tekhn.red.

[Periodic law; supplementary materials] Periodicheskii zakon; dopolnitel'nye materialy. Red.i kommentarii B.M.Kedrova. Moskva, Izd-vo Akad.nauk SSSR, 1960. 711 p. (MIRA 14:2)

1. Chleny-korrespondenty AN SSSR (for Delone, Koshtoyants, Samarin). (Periodic law)

PASTER, Lui [Pasteur, Louis]; IMSHENETSKIY, A.A., red.; PETROVSKIY, I.G., akademik, red.; ANDREYEV, N.N., akademik, red.; BYKOV, K.M., akademik, red. [deceased]; KAZANSKIY, B.A., akademik, red.; OPARIN, A.I., akademik, red.; SHMIDT, O.Yu., akademik, red. [deceased]; SHCHERBAKOV, D.I., akademik, red.; YUDIN, P.F., akademik, red.; KOSHTOYANTS, Kh.S., red.; SAMARIN, A.M., red.; MAKSIMOV, A.A., red.; LEBEDEV, D.M., doktor geograf.nauk, red.; FIGUROVSKIY, N.A., doktor khim.nauk, red.; KUZNETSOV, I.V., kand. filosof.nauk, red.; OZNOBISHIN, D.V., kand.istor.nauk, red.; MATVEYENKO, T.A., red.izd-va; DOROKHINA, I.N., tekhn.red.

[Selected works in two volumes] Izbrannye trudy v dvukh tomakh. Red.A.A.Imshenetskogo. Moskva, Izd-vo Akad.nauk SSSR. Vol.1. 1960. 1012 p. (MIRA 13:11)

1. Chleny-korrespondenty AN SSSR (for Imshenetskiy, Koshtoyants, Samarin, Maksimov).
(MICROBIOLOGY)

18.8100
3.4400

68683
S/180/60/000/01/003/027
E071/E135

AUTHORS: Van Tszin-Tan, Karasev, R.A., and Samarin, A.M. (Moscow)

TITLE: The Influence of Carbon and Oxygen on the Surface Tension of Liquid Iron

PERIODICAL: Izvestiya Akademii nauk SSSR,Otdeleniye tekhnicheskikh nauk, Letallurgiya i toplivo,1960, Nr 1, pp 30-35 (USSR)

ABSTRACT: The results of the determination of surface tension of liquid iron and its changes under the influence of carbon and oxygen are reported. The surface tension was measured by the method of a laying drop in an atmosphere of purified helium. The apparatus is shown in Fig 1. The method of calculating the surface tension from the shape of the iron drop was described previously (Ref 8). Two methods of heating the drop, resistance and high frequency, were used, in order to compare the data obtained with various heating methods and be able to carry out the determinations at temperatures above 1650 °C. The sample of iron used in the experiments contained 0.001% of oxygen, 0.001-0.002% of carbon, 0.002% of sulphur, less than 0.002% of nitrogen and traces of copper, silicon and nickel. The experimental results are given in the Table (p 32) and Figures 2, 3, 4, 5 and 6. It was found that:

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The Influence of Carbon and Oxygen on the Surface Tension of Liquid Iron

1) The surface tension of liquid iron at 1550 °C is 1865 dyn/cm. The temperature coefficient of surface tension $d\sigma/dt = -0.49$ dyn/cm °C.
2) At 1550 °C carbon has no substantial influence on the surface tension of iron. With increasing carbon content from 0.002 to 4.15% the surface tension decreases from 1865 to 1788 dyn/cm. At temperatures below 1520 °C the temperature coefficient of surface tension of liquid iron containing from 2.0 to 4.2% carbon decreases from 1.0 to 0.42 dyn/cm °C. At about 1550 °C polytherms of solutions of carbon and iron reach a maximum. At the same degree of overheating (Δt = 20 °C) of solutions of iron and carbon, an increase in the concentration of carbon has a substantial influence on the surface tension of iron (Fig 6).
3) Oxygen, as a highly surface active element, reduces considerably the surface tension of iron. With increasing concentration of oxygen from 0.001 to 0.184% the surface tension of iron decreases from 1865 to

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1056 dyn/cm.
4) The maximum adsorption of oxygen amounts to 23.4×10^{-10} mol/cm^2 at an oxygen concentration of about 0.05%. The authors consider that a mixture of ferrous oxide and ions of oxygen with a predominance of the former is present in the surface layer.
There are 6 figures, 1 table and 14 references, of which 9 are Soviet, 4 English and 1 German.

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SUBMITTED: October 29, 1959

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S/137/62/000/012/005/085
A006/A101

AUTHORS: Samarin, A. M., Polyakov, A. Yu., Belkov, S. F., Okorokov, G. N.

TITLE: The effect of vacuum arc remelting upon the quality of bearing steel

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 12, 1962, 45, abstract 12V286 ("Tr. N.-i. i eksperim. in-ta podshipnik. prom-sti", 1960, 1, (21) 41 - 54)

TEXT: The authors investigated the effect of vacuum arc remelting techniques upon the quality of bearing steels. Data are presented on the effect of electric conditions of the vacuum rarefaction, the magnitude of inflow and the strength of the solenoid magnetic field upon the quality of the ingots (changes in the chemical composition and completeness of metal refining). It was established that the use of vacuum arc remelting reduces contamination of bearing steels by non-metallic inclusions, and its gas saturation. It is noted that in the process of vacuum remelting Mn and Si content are somewhat reduced. It was established that the electromagnetic mixing of the pool entails the formation

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The effect of vacuum arc remelting upon...

of pores in high-carbon steel ingots and does not affect metal refining. It is mentioned that O_2 and S are uniformly distributed over the height and diameter of the Sh15 steel ingot and that only in the zone of shrinkage cavities an increased O content is observed. The pressure in the melting space of the furnace varied within a range of $10^{-4}-5 \cdot 10^{-2}$ mm Hg and did not affect the decrease in the O content and oxide inclusions. There are 5 references.

A. Savel'yeva

[Abstracter's note: Complete translation]

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69653

S/180/60/000/02/007/028
E071/E135

18.1100

AUTHORS: Van Tszin-Tan, Karasev, R.A., and Samarin, A.M. (Moscow)

TITLE: Surface Tension of Molten Iron-Manganese and Iron-Sulphur Alloys

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 2, pp 49-52 (USSR)

ABSTRACT: Results of measurements of surface tension of melts in the system Fe - S and Fe - Mn are reported. The measurements were done using the method (shape of the drop) and apparatus previously described (Ref 2). High purity iron (0.001% O; 0.001-0.002% C; 0.002% S; less than 0.002% N, Cu, Si and traces of Ni), electrolytic manganese (0.05% S, 0.06% C) and chemically pure sulphur were used for the preparation of alloys. Melting of the specimens was done in an atmosphere of purified hydrogen which was then removed from the metal by heating at 600 °C in a vacuo of 1.10^{-5} mm Hg. Surface tension values of iron-manganese melts are given in Table 1 and Fig 1, and of iron-sulphur melts in Table 2 and Figs 2 and 3. It was found that the presence of manganese in

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Surface Tension of Molten Iron-Manganese and Iron-Sulphur Alloys

liquid iron reduces its surface tension from 1865 dyn/cm (for pure metal) to 1372 (for iron containing 6.15% of manganese). Unlike the findings of other authors (Refs 4, 5, 6) the dependence of the surface tension on concentration was found to be uniform (Fig 1). The presence of sulphur in liquid iron causes a sharp decrease of surface tension: from 1865 dyn/cm for pure iron to 702 dyn/cm for iron containing 3.44% of sulphur. In the region of very dilute solutions the influence of sulphur on surface tension of liquid iron is higher than that of oxygen. The temperature coefficient of the surface tension of Fe-S melts is positive and equals 0.34 dyn/cm °C. The maximum adsorption of sulphur in liquid iron amounts to $14.60 \cdot 10^{-10}$ mol/cm^2 at a concentration of sulphur of 0.03%. Thus at the maximum adsorption the surface area per molecule in the adsorption layer amounts to $11.38 \cdot 10^{-16}$ cm^2. Comparing this figure with ionic dimensions of particles of elemental sulphur ($10.41 \cdot 10^{-16}$ cm^2) and iron sulphide ($11.56 \cdot 10^{-16}$ cm^2), it

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can be assumed that the surface layer is filled mainly with particles of iron sulphide.
There are 3 figures, 2 tables and 8 Soviet references.

SUBMITTED: December 21, 1959

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80975

S/180/60/000/03/002/030
E111/E352

18.9100

AUTHORS: Vertman, A.A., Samarin, A.M. and Yakobson, A.M. (Moscow)

TITLE: Structure of Liquid Eutectics

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 3, pp 17-21 (USSR)

ABSTRACT: V.I. Danilov and collaborators (Refs 1,2) carried out X-ray scattering work on liquid eutectic alloys. It was concluded (Ref 1) that in such liquids groupings exist with the structure of one of the components. The present authors do not consider the evidence unambiguous and mention another explanation (Ref 3) and views based on other experimental methods (Refs 5-8). The authors consider sedimentation-analysis methods promising for determining the size of "colonies" in the liquid state and describe their work using this technique with a centrifuge for Pb-Sn (K.P. Bunin -(Ref 9) had previously shown the applicability of this method). They used a high-temperature centrifuge, the two cups of which contained resistance furnaces. The rotating shaft was provided with rings and brushes, the wires passing through the hollow shaft and hollow cupholders. The test alloys, in a thick-walled steel crucible, were slowly

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Structure of Liquid Eutectics

heated to the required temperature. After rotating at 5 600 rpm for 15-30 min the crucibles were withdrawn and quenched in water. Furnace temperature was again measured, the experimental temperature being the mean of this and the first temperature. A reference sample was heated in an identical stainless-steel crucible and quenched in water; its composition was taken to be the initial composition of the centrifuged alloy. The crucibles with the centrifugal samples were cut in half vertically and drilled for analysis at different depths. The results (tabulated) showed that centrifuging produced significant concentration differences between top and bottom. From this the authors calculate the volume of the "colonies" to be 91×10^{-21} cm^3 at 225 °C, 130×10^{-21} at 380 and 109×10^{-21} at 800 for alloys with 76.0, 74.0 and 74.0 at.% Sn, respectively. Such a separation is possible if the colonies are of the order of 10^3 atoms. This agrees with Barten'yev's views (Ref 10).

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There are 1 table and 10 references, 9 of which are Soviet and 1 English.

SUBMITTED: June 28, 1959

Card 3/3

S/180/60/000/03/022/030
E111/E352

AUTHOR: Samarin, A.M. (Moscow)

TITLE: Problems in the Field of Quality Improvement of Electro-technical Steels and Alloys

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 3, pp 117-120 (USSR)

ABSTRACT: This paper was presented at the general meeting of the OTN AN SSSR (TsD AN SSSR) on March 29, 1960.
The author points out the increasing importance of materials quality in the successful development of the electrification of the USSR and goes on to deal with specific fields. Production of silicon steels is shortly to be exclusively cold-rolled: thickness reduction to 0.35 mm and under is desirable on technical and economic grounds. Its chemical purity can have a great effect on core losses and the successful experience at the Dneprospetsstal'" and Verkh-Isetsk Works shows that vacuum treatment is a good way of achieving this. The author recommends wider use of this technique. Production of a "cubic" texture in silicon steel, high-temperature insulating materials for application on continuously working

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Problems in the Field of Quality Improvement of Electrotechnical Steels and Alloys

installations and non-inflammable and non-oxidizing cooling fluids and methods of drying hydrogen are urgent topics for research. Iron-aluminium alloys have better electrotechnical properties than silicon steels and enable weights of equipment to be reduced with construction simplification; their industrial production must be organized and best compositions, melting methods and rolling conditions elucidated. Although vacuum casting has largely eliminated hydrogen flaking in large castings used for turbine and generator shafts, better deoxidizing methods to reduce non-metallic inclusions are necessary. Vacuum melted ingots have the advantage of a very uniform distribution of impurities; an arc vacuum melting furnace capable of producing ingots about 1 m in diameter is now being built and the construction and uses of such furnaces should be extended. The unsatisfactory state of the metallurgy of semiconductors is hampering the developments in this field. The production of silicon and germanium, especially the former, should be improved. The

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Problems in the Field of Quality Improvement of Electrotechnical Steels and Alloys

author gives as the aim of research in this field production of silicon with only 1 part impurity per 6 milliard parts silicon. Better techniques for obtaining the materials in a shape closer to that finally required are also needed. Aluminium should as far as possible replace copper and lead in electrical equipment and its purity should be increased. A process for the production of steel-aluminium cables must be developed quickly. Further copper economies could also be effected, by its better deoxidation. Possible applications of pure iron should be considered and resistance heating materials further developed. The author recommends the compilation of a research plan in the near future for satisfying electrical industry requirements.

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S/180/60/000/004/015/027
E193/E483

AUTHORS: Vertman, A.A. and Samarin, A.M. (Moscow)

TITLE: Viscosity of Liquid Silver-Copper Alloys

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.4, pp.95-98

TEXT: The temperature and concentration dependence of the dynamic and kinematic viscosities of silver, copper, and silver-copper alloys in the 1020 to 1420°C range, was determined. The results were in good agreement with those obtained by Gebhardt (Ref.3), Sauerwald (Ref.4,6) and Barfield (Ref.5). However, the shape of the viscosity isotherms obtained by the present authors was essentially different from those constructed by Gebhardt, probably because of the higher degree of oxidation of the alloys investigated by the latter author. The results of the present investigation are discussed in correlation with those obtained by other workers who have studied viscosity and other properties of eutectiferous systems, and certain conclusions regarding the structure of all alloys of this type are reached. Commenting on contradictory findings reported by various workers, the present authors discount the possibility that these differences are due to

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Viscosity of Liquid Silver-Copper Alloys

factors such as different degree of oxidation and volatization of the experimental alloys or different impurities' contents. They postulate that the properties of liquid, eutectiferous alloys are not necessarily determined by their properties in the solid state and that, as it has been demonstrated by Regel' and Gaybullayev (Ref.17), various types of eutectic alloys may exist, depending on the nature of the bond between the elementary particles of the two metals. The results of centrifuging experiments conducted by Bunin (Ref.9) and X-ray studies carried out by Danilov (Ref.8) support the view that liquid, eutectic alloys consist of micro-volumes, enriched by one of the components, these micro-volumes being surrounded by homogeneous solution. In alloys of the eutectic composition, the quantity of the solution surrounding the non-equilibrium micro-volumes, is at its minimum and it is this factor to which the present authors attribute the fact that the viscosity/concentration curves for the silver/copper system pass through a minimum at the point corresponding to the eutectic composition. This effect is explained in terms of the "solution energy", V/k. If V/k is $\gg 0$, the forces, bonding similar particles, are larger than those between dissimilar

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Viscosity of Liquid Silver-Copper Alloys

particles, in which case the least viscous part of the molten alloy should be represented by the boundary layer of the micro-volumes, since there the number of weak bonds of the AB type is minimum. If either A or B component is added to an alloy of the eutectic composition, the number of strong bonds between the similar particles increases and so does the viscosity of the alloy. Consequently, the shape of the viscosity isotherms for any given eutectiferous system will depend on the relative magnitude of the AA, BB and AB bonds. There are 6 figures, 2 tables and 19 references: 11 Soviet, 4 German and 4 English.

SUBMITTED: February 8, 1960

Card 3/3

LEVENETS, N.P.; SAMARIN, A.M.

Use of oxygen in converter refining of phosphorous pig iron. Trudy Inst.met. no.5:8-15 '60. (MIRA 13:6)
(Cast iron--Metallurgy)
(Oxygen--Industrial applications)

KULIKOV, I.S.; SAMARIN, A.M.

Investigating sulfur absorbing properties of magnesium and calcium oxides. Trudy Inst.met. no.5:16-21 '60. (MIRA 13:6)
(Magnesium oxide)
(Calcium oxide)
(Desulfuration)

FORYST, Yu.T.; MCHEDLISHVILI, V.A.; SAMARIN, A.M.

Effect of deoxidation by a complex alloy of manganese silicon and aluminum on the content and composition of oxide inclusions in steel. Trudy Inst.met. no.5:22-35 '60. (MIRA 13:6)
(Steel alloys--Metallurgy)

S/180/60/000/006/023/030
E111/E335

AUTHORS: Vertman, A.A., Samarin, A.M. and Turovskiy, B.M. (Moscow)

TITLE: Structure of Liquid Alloys of the Iron-carbon System

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No. 6, pp. 123 - 129

TEXT: The authors point out that in spite of their technical importance, views of liquid structures in the iron-carbon system are incomplete and contradictory. They now discuss thermodynamic data in relation to the structurally sensitive properties of iron-carbon alloys. Many investigations (Refs. 4-7) agree well and indicate considerable deviations from ideality. These can be due to heat of solution or entropy of mixing factors but thermodynamic data are insufficient for a detailed picture of the melts. If graphite is taken as the standard state (the possibility of iron solution in it must be recognised, Ref. 8), compounds which are mutually soluble are assumed to be formed (Ref. 9). If the standard state is

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Structure of Liquid Alloys of the Iron-carbon System

carbon-saturated iron negative deviations prevail at all concentrations. The authors consider that data are now available on which the alloys' structure can be explained more definitely. The results of Bunin (Ref. 10) and Konobeyevskiy (Ref. 8) suggest that relatively large groupings of graphite exist in liquid iron-carbon. This idea receives further confirmation from the work of Ivanov (Ref. 11) and of Khrapov and Chernobrovkin (Ref. 12). It appears (Refs. 15-17) that these eutectic colonies consist of thousands of atoms and the carbon formations have, in liquid cast iron, a diameter of the order of 10^{-6} cm (Ref. 18). In fact the colloidal view (Ref. 19) of liquid alloys is in line with experimental observations (Refs. 20, 21 or 22, 23, shown in Fig. 1, or Refs. 24, 25). Fig. 2 shows plots of resistivity of Fe-C alloys versus temperature at various carbon contents (0 - 5.25%). Viscosity results (Refs. 24, 25) provide further support (Fig. 3 shows the free-energy of viscous flow as a

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function of carbon content in atomic %). So do magnetic-susceptibility measurements (Ref. 28) (Fig. 4 shows the 1550 and 1700 °C isotherms of susceptibility vs carbon content). Discussing the experimental evidence the authors conclude that at over 2.0% C from the melting point to 1700 °C Fe-C alloys are colloidal solutions and thermodynamic data on them cannot be extrapolated outside these concentrations. Thermodynamic investigations in which a tendency to immiscibility in Fe-C alloys was noted are supported by the physical-property studies considered. Of the authors, Vertman and Samarin have made previous contributions in this field (Refs. 16, 17, 18, 28). There are 4 figures and 29 references: 23 Soviet and 6 non-Soviet.

SUBMITTED: August 26, 1960

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SAMARIN, A.M.

Problems in increasing the quality of steels and alloys used in electric engineering. Elektrichestvo no.7:1-4 Jl '60. (MIRA 13:8)

1. Chlen-korrespondent AN SSSR.
(Electric engineering--Equipment and supplies)
(Metals)

S/148/60/000/007/019/023/XX
A161/A033

AUTHORS: Chernyakov, V. A., Samarin, A. M.

TITLE: Desulfuration in transformer steel melting

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 7, 1960, 37 - 41

TEXT: The investigation purpose was to find a way to shorten the reduction period in the transformation steel melting process in electric furnaces. Some plants are practicing deoxidation by addition of aluminum or silicocalcium after skimming the oxidizing slag, and then holding the bath under slag that forms in the result of multiple charging of a mixture of lime with powdered ferrosilicon and aluminum, or silicocalcium. Lump ferrosilicon is added after this treatment to add silicon. The total duration of the reducing period is 1.5 - 2 hours, and is needed for desulfuration. It had been stated previously (Ref. 1: Z. Buzhek, A. M. Samarin, Zavisimost' meshdu desul'furatsiey i raskisleniyem stali (Dependence between Desulfuration and Deoxidation of steel) Izv. AN SSSR, OTN, 1957, No. 9) that silicon speeds up desulfuration. Experiments at the Moscow Steel Institute were carried out with a high-frequen-

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Desulfuration in transformation steel melting

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cy induction furnace of 40 kg capacity, using a magnesite crucible. Soft iron chippings with 0.1 % C and 0.4% Mn were used for the metal charge, and some electrode steel cuttings were added to obtain about 0.4 % of carbon in the liquid metal. Slag was produced using the mixtures. 1) 50 % lime, 39% sand, and 11 % alumina; 2) 50 % magnesite powder, 30 % fireclay brick, 15 % alumina and 5 % lime. MgO content in lime-containing slag rose to 10 - 15 % due to erosion of the crucible. The metal samples were taken by suction into a quartz tube, and slag samples by freezing onto a metal rod. The effect of Si was observed by additions of 75-% powder ferrosilicon and later of lump ferrosilicon. The sulfur content dropped rapidly after the addition of lump ferrosilicon (Figure 1, solid lines). In the second heats series (6672, 6673, 7685, 7686), the same slag compositions were used, but all ferrosilicon needed for alloying was added at the beginning of the reduction period, after the removal of the oxidizing slag. Ferrosilicon was charged onto the metal surface, and the produced slag was deoxidized with ground 75-% ferrosilicon. In the 2nd series the desulfuration was markedly higher (Figure 1, dashed lines), and the sulfur content in the ready steel was lower. The effect of silicon on the sulfur activity factor is one of the factors speeding up desulfuration. According to

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Desulfuration in transformation steel melting

Morris and Williams (Ref. 2: The Effect of Silicon on the Activity of Sulfur in Liquid. Iron Tran. Am. Soc. Metals, 1949, v. 41, 1425) the sulfur activity factor is nearly twice as high at 4 % Si content as in pure iron. If all the ferrosilicon is added in the beginning of the reduction period during the shorter time, the oxygen content in metal is low (Figure 2, dashed lines). The effect of the slag composition was studied on heats under magnesium-aluminum slags with 35 - 40 % MgO, 7.0 - 10 % Al_2O_3, and 30 - 35 % SiO_2. Deoxidation and silicon additions were applied in two different ways. The rate and degree of desulfuration under magnesium-alumina slag was lower than under lime slag. The sulfur content in ready steel was three times higher than with lime slag (Figure 3) The early addition of silicon had no marked effect on the desulfuration in the case of magnesium-aluminum slag. (Figure 4). The content of nonmetallic inclusions in steel practically did not depend on the melting method. This may be explained by the small size of the laboratory furnace and the mixing of metal in it. Conclusions: 1) Desulfuration and deoxidation of liquid transformer steel occur simultaneously. 2) The rate and degree of desulfuration are higher when silicon is added in the beginning of the reduction period. A low sulfur content is reached in a shorter time, and the reduction

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period can be made shorter. 3) The rate and completeness of desulfuration is considerably higher among slags with a high calcium oxide content than among magnesium-alumina slags. There are 4 figures and 2 references: 1 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English language publication reads as follows: J. P. Morris and A. J. Williams. J. the Effect of Silicon on the Activity of Sulphur in Liquid Iron. Tran. Am. Soc. Metals, 1949, v. 41, 1425.

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TITLE: The quality of steel produced in a duplex-process converter-electric furnace

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 9, 1960, 50-56

TEXT: The use of a duplex-process converter-electric furnace had been decided by the XXth congress of the CPSU, and experiments were necessary in view of no previous experience with this method at the USSR plants. The goals were: 1) To study the process in a converter with an oxygen blast, and the process in an electric furnace using the converter steel; 2) To compare the process in the electric furnace with solid charge with the process with the liquid semi-product; 3) To evaluate the quality of steel produced by the duplex-process. Liquid metal for arc furnaces was produced in converters of 40 and 350 kg capacity with the oxygen blast from the top; steel from the first converter was poured into a 100 kg arc furnace and from the second into a 500 kg arc furnace. Open hearth pig iron

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molten in the 350 kg converter contained 3.86-4.34% C; 1.19-2.63% Mn; 0.29-1.06% Si; 0.095-0.23% P; 0.019-0.050% S; 0.0084-0.0133% N_2. It was melted in an 0.5 ton electric furnace with basic lining and poured into the converter; blasting started at 1280-1320°C in metal, at a rate of 30-60 m^3/ton; blasting lasted 7-13 min. The change in chemical composition of the metal in a small converter was practically the same as in melting in large converters (Fig.1). The electric furnace process was studied in melting ШХ15 (ShKh15) and "45" steel, in 100 kg and 500 kg arc furnaces with basic lining. For ShKh15 steel the charge in the 100 kg furnace consisted of 70-75% scrap metal and 25-30% liquid semi-product; two heats were melted with oxidization with iron ore and gaseous oxygen, and one without oxidizing; four heats were melted with solid metal charge and oxidation for comparison. In the 500 kg furnace two heats were melted with a liquid semi-product; slag mix from lime and fluorspar; the bath was oxidized with iron ore and oxygen. Three heats were melted for comparison with a solid charge and iron ore. The reducing period in both furnaces was carried out with carbide slag and ferrochrome addition directly onto the bath surface. Steel "45" was melted from a liquid semi-product, with slag mix of lime and fluorspar,

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